QK1
.M593
v. 21
1933
copy 2

MISSOURI BOTANICAL GARDEN BULLETIN

VOLUME XXI

WITH 42 PLATES

1933

ST. LOUIS, MISSOURI

PUBLISHED MONTHLY EXCEPT JULY AND AUGUST,
BY THE BOARD OF TRUSTEES

SUBSCRIPTION PRICE:

ONE DOLLAR A YEAR — SINGLE NUMBER TEN CENTS

MISSOURI BOTANICAL
RECEIVED
MISSOURI BOTANICAL
GARDEN LIBRARY
GARDEN LIBRARY

MISSOURI BOTANICAL GARDEN BULLETIN

Vol. XXI JANUARY, 1933 No. 1

CONTENTS

Page

Forty-Fourth Annual Report of the Director 1

Statistical Information 36

ST. LOUIS, MO.
1933

Published Monthly, Except July and August, by the Board of Trustees

SUBSCRIPTION PRICE:

ONE DOLLAR PER YEAR SINGLE COPIES TEN CENTS

BOARD OF TRUSTEES
OF THE MISSOURI BOTANICAL GARDEN

THE ORIGINAL MEMBERS WERE DESIGNATED IN MR. SHAW'S WILL AND THE BOARD SO CONSTITUTED, EXCLUSIVE OF THE *EX-OFFICIO* MEMBERS, IS SELF-PERPETUATING

President
GEORGE C. HITCHCOCK

Vice-President
SAMUEL C. DAVIS

Second Vice-President
DANIEL K. CATLIN

L. RAY CARTER

ALBERT T. PERKINS

THOMAS S. MAFFITT

EUGENE PETTUS

GEORGE T. MOORE

ETHAN A. H. SHEPLEY

FRED G. ZEIBIG

EX-OFFICIO MEMBERS

GEORGE R. THROOP,
Chancellor of Washington University

VICTOR J. MILLER,
Mayor of the City of St. Louis

FREDERICK F. JOHNSON,
Bishop of the Diocese of Missouri

JOHN J. LICHTER,
President of The Academy of Science of St. Louis

MYRT A. ROLLINS
President of the Board of Education of St. Louis

Secretary
GEORGE F. HEFFERNAN

HENRY SHAW MEDAL

To be offered for the first time at the National Flower and Garden Show, St. Louis, March 25-April 2, 1933.

Missouri Botanical Garden Bulletin

Vol. XXI JANUARY, 1933 No. 1

FORTY-FOURTH ANNUAL REPORT OF THE DIRECTOR

Gentlemen:

I have the honor to submit herewith the forty-fourth annual report of the Director.

Unlike the past few years, the year 1932 was not marked by any significant event which calls for special discussion. On the contrary, the activities for the year have been chiefly those of maintenance, with certain minor improvements, which of themselves are not of great importance, but when taken together constitute a distinct advance along various lines.

The providing of an additional exit from the floral display house has been something long contemplated, but it was only completed in time for the chrysanthemum show. Accommodating the large crowds which come to view this display, particularly on Sunday afternoons, has always been a problem. In the past, it has been necessary to use the north service door as an exit, but this has never been satisfactory, with three or four thousand visitors passing through the house every hour and insisting on making the entire circuit. Now, however, with exit doors at the south end, visitors come in at the east entrance, make the entire circuit of the display, and leave either by the new exit direct, or if they wish may go through the aroid house past the orchid alcoves, and either

leave by the west doors from this range or return through the citrus house to the new south exit. No single improvement in recent years has contributed so much to the comfort of visitors when large crowds are in attendance.

The establishment by the street department of a much-needed safety zone at the main entrance to the Garden on Tower Grove Avenue has added much to the convenience and speed of handling crowds alighting here from private automobiles, street cars, and buses. It has also provided a satisfactory solution to the problem of permitting pedestrians to cross the street safely at this point, when leaving the Garden.

The item which perhaps gave the Garden more publicity than any other during the year was the importation from the Sumatran jungles of two giant bulbs of *Amorphophallus Titanum*. One of these bulbs is 6 feet 5 inches in circumference and weighs 120 pounds; the other weighs 92 pounds, and is 5 feet 6 inches in circumference! The fact that these bulbs belong to the same family as the well-known "jack-in-the-pulpit" brought forth the facetious remark from the press that: "In the relative rank of pulpit occupants these Sumatra jack-in-the-pulpits are the Harry Emerson Fosdicks and Henry Ward Beechers of their kind"; and another, "If that new jack-in-the-pulpit at Shaw's Garden is ten feet high, oughtn't we to call him 'John'?" Probably no plants in the Garden have had such a long voyage, since they journeyed over 10,000 miles, by way of the Suez Canal, the Mediterranean, through the Straits of Gibraltar, across the Atlantic, and finally overland from New York to St. Louis. Though it will be several years before these bulbs blossom, the flower stalk will be worth waiting for, since it is expected to be at least ten feet tall.

Particular attention has been paid during the year to repairs and upkeep of greenhouses and buildings, including a new roof on the old residence and extensive repairs on the roofs of other buildings. The roofs of many of the greenhouses have been gone over and the amount of outside painting on these houses has exceeded that done in any previous year. As a result it can be safely said that the physical

condition of all the houses at the Garden is better than at any time since their original construction.

In anticipation of the Fourteenth National Flower and Garden Show to be held in St. Louis next spring, the Trustees of the Garden authorized the striking of a gold medal, to be known as the "Henry Shaw Medal" (plate 1). Some years ago a small gold medal was offered by the Garden and was awarded on three occasions. However, this was not regarded as being distinctive enough to warrant its continuance, and a more artistic and valuable medal has been substituted. Mr. Victor S. Holm, the St. Louis sculptor, was selected to design this medal and he has been most successful. On its face the medal bears a *bas-relief* of Henry Shaw modeled after one of his older portraits, and on the reverse side is a wreath of conventionalized leaves and fruit of the hawthorn, an especially appropriate choice, since it is the Missouri state flower. The Numismatic Society of New York has requested a bronze replica to be placed in its collection, and it is believed that the Henry Shaw medal, because of its beauty and the conditions under which it is to be awarded, will come to be recognized as one of the most coveted trophies of the horticultural world. At the coming show it is offered for the "best American grown foliage or flowering plant not previously shown, exhibited by the originator. To be eligible, exhibits must score ninety points or more and be adaptable for growing by amateurs." These conditions, while severe, were framed with the idea of stimulating growers to develop new varieties, which will be distinct additions to horticulture and yet can be widely grown by lovers of plants. Although the medal will be offered annually, it is not expected that it will be possible to award it every year. This show promises to be one of the largest and most significant ever held by the national organization, and the Garden is planning to be well represented. Mr. George H. Pring, Superintendent of the Garden, is a member of the local executive committee in charge of installations.

The increasing use of the "Museum and Library" building, which was restored two years ago to serve as an auditorium, with offices in the south room, is evidence of the wisdom of its restoration. This south room has been used

since early in 1931 by the St. Louis Horticultural Society for office purposes and committee meetings. During 1932, at the request of Dr. K. C. Sullivan, Plant Commissioner for the State of Missouri, Mr. Charles Denny, State Entomologist, has been given desk space in this same room. This arrangement was welcomed by the State Board of Agriculture, and it will be of considerable advantage to the Garden to have a trained entomologist available for advice.

The auditorium has been used often throughout the year by garden clubs and societies interested in nature study. The lectures in the course offered to amateurs in gardening were also given in this room. In February, Dr. Georg Tischler, professor of Botany, Christian Albrechts University, and Director of the Botanical Institute and Gardens, Kiel, Germany, delivered a public lecture in this building on "Chromosomes and Inheritance."

On August 25, the forty-third anniversary of the death of Henry Shaw was commemorated at the Garden, in a way perhaps best described in the following editorial, which appeared in the ST. LOUIS POST-DISPATCH on that date:

"OUR DEBT TO HENRY SHAW"

"A wreath of magnolia leaves and orchids today leans against the marble figure of Henry Shaw among the oaks and horse chestnuts of his beloved Tower Grove. Director Moore placed it there at noon in the presence of some 50 workers of the garden, who left their varied tasks to keep, on the anniversary of his death, the memory of the man whose generosity makes possible their comradeship with the beauties of flower and shrub and tree.

"All St. Louis, in spirit, at least, might well have attended that simple ceremony. What Henry Shaw did was truly unique in the world and it has redounded to the glory of St. Louis, as it will continue to do for seasons of bloom without end. Born in Sheffield, England, 132 years ago, as a boy reader of books in an arbor of blossoming vines, he made a fortune selling merchandise on the western edge of the new world. When he died, the St. Louisans of the horse car days and all their descendants were named his heirs.

"Almost without exception, other public botanical gardens and arboreta are tax supported or connected with institutions of learning. Shaw's Garden, or the Missouri Botanical Garden, as he modestly designated it in his will, is maintained

entirely from funds he left, that the city and its visitors might gain the refreshment of communion with nature's wonders of color and scent. Instead of requiring city money, the garden, since its founder's death, has paid St. Louis more than $2,000,000 in taxes. Today, besides the 75 acres at Flora place, on which 12,000 species of plants grow, there is being developed a tract 20 times as large at Gray Summit, whose arboretum, now begun, will be without question one of the prides of the St. Louis of the future.

"In recent years there has been a tendency to forget the part of the quiet man who built his, now our, garden during the Civil War. He whose bequest on the one hand benefits world science by contributions from its beds and laboratories, and, on the other, gives untold pleasure to increasing thousands of visitors, deserves our continuing gratitude."

On July 25, 1882, a newspaper editorial, regarding the eighty-second birthday celebration of Mr. Shaw, stated: "It was through the efforts of Henry Shaw that Tower Grove Park and Shaw's Garden became the principal suburban attractions of St. Louis."

MAIN CONSERVATORIES

Palm House.—A new walk connecting the east and west entrances has opened up the central planting of this house so that visitors can get a better view of some of the larger plants. Particularly when the palms are in flower or fruit is it desirable to be able to view them at close quarters. During the year the following have borne both flowers and fruit: *Livistona australis, L. chinensis, Pritchardia pacifica, Martinezia erosa, Chamaedorea corallina, Elaeis guineensis,* and *Sabal Palmetto.* Seeds of these falling to the ground under the parent plant germinated and produced seedlings in great numbers. Palms which flowered but did not fruit were *Coleospadix oninensis, Kentia Macarthuri, K. Belmoreana, Astrocaryum mexicanum, Hydriastele Wendlandiana, Phoenix dactylifera, P. sylvestris,* and *P. canariensis. Cocos plumosa* and *C. flexuosa,* having reached the roof, were cut down and replaced by smaller specimens of the same plants. The large date palm, which had been partially supported from the roof girders, had to be removed, as it was no longer safe to permit it to hang over the walk. It weighed five tons.

Cycad-Fern House. — The large *Cycas Rumphii* was removed from the west bank to the center of the house to permit more room for future growth. The west bank was practically rebuilt, using a quantity of loose rock to retain better the maidenhair ferns established there. In order to display the large number of staghorn ferns, in several species, concrete pillars covered with cork bark have been introduced at effective locations. The following cycads fruited during the year: *Dioon edule, Encephalartos caffer, Ceratozamia mexicana, Cycas circinalis, C. Micholitzii,* and *C. siamensis.*

Economic House.—The group of fiber-producing plants was rearranged and various minor changes in planting were made. As usual, fruiting of tropical plants such as the mango, the papaya, the jack-fruit, etc., attracted attention, particularly from the visiting school children. Many of the tropical vines and perfume plants flowered exceptionally well.

Coffee and Banana House.—No changes of any importance have been made. The fact that visitors can see here fruiting banana plants and coffee trees in quantity at practically any time of the year makes the house one which always arouses interest.

Succulent House.—This house, which was closed for six months last year on account of the wholesale theft of cacti and other smaller succulents, was reopened to the public late in March. Since then many new and odd specimens have been added and the old plants have been relabeled according to the latest nomenclature. At present there are 462 named species of succulents, including 144 species of cacti. At least another hundred succulents are unnamed as yet, since more mature plants are required for identification. Many packets of seed of succulents have been purchased and about 700 seedlings are now growing. These include many of the quaint and interesting stemless plants which until a few years ago were known under the name Mesembryanthemums. Plants of this group are notable for the so-called "phenomenon" of mimicry, and it was a collection of these mimic plants of Lithops, Pleiospilos, Cheiridopsis, Conophytum, etc., which formed a part of the small display of succulents in the floral display house during the summer months. Visitors to the

Garden show great interest in the succulent house, where are to be seen many strikingly grotesque forms of plant life. Popular names, both picturesque and descriptive, have been attached to the different specimens, greatly increasing the public interest in the collection. Two frames containing colored photographs of flowering cacti and other succulents have been installed, one on each side of the walk near the entrance. These answer the often-repeated question: "Do cacti flower?"

Linnean House.—Aside from the unusual landscaping in this house, which always interests visitors, the chief attraction is the collection of camellias. During the winter months the house is a mass of color produced by the pure white, red and pink, as well as variegated, varieties of these flowers.

FLORAL DISPLAY RANGE

Propagating and Growing Houses. — These greenhouses are not open to the public, and consequently little is known of the vast number of seedlings and cuttings which have to be grown for indoor shows and outdoor bedding. Ten houses, a lean-to, and a cold-storage house are used for this purpose, where during a single year over 50,000 plants of all sorts and descriptions must be brought to perfection. No new houses have been built, but the expansion of the water-lily department has required the construction of two additional tanks, making seven in all. Here over 2,000 seedlings from breeding experiments have been raised, in addition to the stock needed for planting the various pools.

Aroid, Bromeliad and Citrus Houses. — Aside from the monthly flower shows maintained in the floral display house, discussed at length below, this range houses a varied collection of aroids, bromeliads, citrus and other economic fruits. The alcoves in the aroid house carry at all times a display of orchids, even when other floral displays are featured. Some of the plants in this range which have flowered recently are: *Clerodendron fallax, Ixora coccinea, Camoensia maxima, Monstera deliciosa,* Dieffenbachias, Aglaonemas, Philodendrons, Anthuriums, etc. In the bromeliad house the red-flowered types of Billbergia and Aechmea, as well as the dark

blue-flowering *Tillandsia Lindeniana,* have been much admired.

INDOOR FLORAL DISPLAYS

Most of the plants used in the floral displays are of large size and attractive in both foliage and flower. Consequently visitors coming to these shows are accustomed to seeing a mass of color artistically arranged. To obtain the same effect with the first show of the year, namely, the orchids, is a difficult problem. Of the various methods of staging orchids that have been tried, that used in 1932 was considered the most effective. A circular evergreen hedge, thirty-seven feet in diameter and ten feet high, of sprays of red cedar closely packed together, was built. The cattleya plants were hooked on to this wall by means of wire, the pots being hidden in the cedar. Niches at regular intervals held such orchids as Cymbidiums, Dendrobiums, and Phalaenopsis. A raised, flagstone walk bordered this hedge, and in front of this walk and at the steps fairy primroses were massed with asparagus ferns. In the center of the enclosure was a huge table entirely filled with Cypripediums and maidenhair ferns.

From March 10 to 13 the floral display house was occupied by the St. Louis Spring Flower Show. This consisted almost entirely of cut flowers, and great quantities of roses, carnations, snapdragons, larkspur, lilies, and other spring flowers were displayed separately or combined in baskets or vases. As in past years, this was an excellent display and it attracted many visitors who annually look forward to enjoying flowers not found in any of the other Garden displays.

Following the florists' spring show an azalea and cineraria display was installed on March 17, and continued until the end of the month. The south half of the house contained a large oval bed filled with cinerarias, with two large informal beds of azaleas at the rear.

During the first week in April the design was entirely changed and stellate cinerarias, which were not displayed with the large-flowered cinerarias, were combined with schizanthus, annual chrysanthemums, marguerites, and other annuals.

VIEW 1932 CHRYSANTHEMUM SHOW

JAPANESE TEA HOUSE, A FEATURE OF THE 1932 CHRYSANTHEMUM SHOW

In early May the display was again rearranged, and snapdragons, salpiglossis, roses, regal lilies, and hybrid pelargoniums formed an effective garden of brilliant colors. On May 20, 21, and 22, the St. Louis Horticultural Society held its spring flower show at the Garden. This was followed by an arrangement of hydrangeas, blue-lace flowers, and asclepias.

During the summer months, from late June to October, foliage plants, such as fancy-leaved caladiums, begonias, and ferns, occupied the floral display house.

From October 8 to 10, the St. Louis Horticultural Society staged the annual dahlia show. Due to this being the first show in the autumn and owing to the increasing interest in the dahlia, the attendance was large.

The chrysanthemum held sway during November and as usual attracted the largest number of visitors. The Garden receives more inquiries as to the opening date of this show, or when it will be at its best, than concerning any other display. Many visitors from a distance come to St. Louis at this time, the "mum show" being commonly regarded as the floral event of the year. It is unquestionably the most brilliant display on account of the great variation in color and shape of the flower and the use of large hanging baskets, which constitute an unusual aerial feature. As in the last few years, the chrysanthemums were arranged in a Japanese setting. A tea house surrounded by a simple Japanese garden made an effective background (plates 2-3).

During the month of December was the Christmas show, which consisted of a border of large poinsettias, with three square formal beds of dwarf poinsettias, coleus, and ageratum in the center. Separated from this display by trellis-work was a second garden of stellate primroses, surrounding a circular pool with pink and white poinsettias at the sides. Later in the month the poinsettias were replaced by budleias.

OUTDOOR PLANTING

Display Gardens.—During the past two years numerous changes have been made in the flower borders on the knolls, and this work will continue until all of the borders, compris-

ing some 3500 lineal feet, will have been reworked. Formerly these borders contained many of the showy native perennials, including species of goldenrods, native asters, helianthus, hibiscus, coreopsis, ox-eye daisies, achilleas, braunerias, geraniums, monardas, violets, and others. The same plants have occupied these beds for a number of years, and as they had to be divided and reset the borders were planted with perennials and annuals to maintain as much color as possible on the knolls during the growing season. Large masses of old varieties of irises are gradually being replaced with newer and better varieties as they become available in quantity. Many new hybrid hemerocallis were planted a year ago and these will bloom next spring. Some of the shrubbery beds also are being replanted. These knolls, comprising an area of approximately four and one-half acres, require a large number of plants to make them presentable throughout the season.

During the year a large number of plants were labeled. Whenever possible, the common name, followed by the botanical name, is printed on a green pyralin card which is inserted in a holder. Experience indicates that the general public prefers a popular or common name, while the specialist wants the botanical name. Each season some 1,100 irises, 225 perennials, 340 annuals, 275 roses and 150 peonies are thus labeled.

All of the beds in the east end of the Linnean garden were replanted during the spring and fall months, and many perennials and annuals have replaced the irises and peonies formerly planted there. The two beds adjoining the rose garden, each measuring 12 x 70 feet, formerly occupied by Japanese irises, have been planted with bulbs and perennials, the bulbs being followed by annuals. The Japanese irises were planted along the borders of the lily pools in the knolls and around the lotus pool west of the greenhouses.

Four beds in the rose garden were planted with forty varieties of hybrid tea roses, three and four plants to the variety. These were trial beds and contained some of the new and also the older standard sorts. Eight new varieties of climbing roses were added to the collection. The beds

were fertilized, and the plants were sprayed in the spring, summer, and fall with Bordeaux mixture, and were dusted twelve times during the summer, at intervals of ten days to two weeks. With these sprayings and dustings defoliation, due to the black spot disease, was reduced to a minimum. The early March freeze damaged some varieties of climbing roses, but others were not injured.

For the test garden of the American Iris Society ninety-four new varieties of iris were received during the summer months. Almost all of the tall bearded irises bloomed freely, but some of the dwarf and intermediate varieties, whose flower buds were injured by the March freeze, did not bloom.

The main, Italian, economic, and medicinal gardens were maintained as in former years, these gardens containing practically the same kind of plants every year. The tropical water-lily pools at the entrance continue to constitute one of the main outdoor floral features during the summer months. In addition to the usual collection of Missouri Botanical Garden hybrids they contained, for the first time in quantity, the various hybrids obtained from the "lost yellow lily," featuring particularly the new "St. Louis," as well as others which promise to be equally attractive.

The hardy water-lily pool north of the medicinal garden was again planted with standard varieties, and the pool of pink lotus (Nelumbium) was a special feature of this part of the garden.

The growing season was fairly satisfactory. More spring rains would have been welcome. Rains did come but not at the time when most needed, and all of the gardens had to be watered frequently. Many plants, particularly shrubs, are still suffering from the last three dry seasons.

Trees and Shrubs.—A year ago the statement was made that most trees will grow vigorously even in an extremely dry season if they are heavily fertilized. Additional proof was furnished this year, which was quite as dry as the two preceding. The walnut trees in the orchard showed an average growth of twenty-six inches in height, the maximum being forty-two inches, even though so little rain fell during the summer. Almost two tons of commercial fertilizer were used

on trees in feeding experiments, nearly four times as much as in 1930. Many trees began to shed their leaves about June 1, and at the same time shrubs were badly wilted. Because these conditions occurred so early in the season much more watering was necessary than last year.

Pruning of the trees and shrubs, including those in the North American tract, occupied a good portion of the year. Some time was devoted to experimental cavity work, including observations on the growth of cambium. Between February 10 and 29, 7,050 gallons of dormant and delayed dormant spray were applied. A new record of 1,450 gallons for one day was established. The hot dry summer proved ideal for red spider, and 3,000 gallons of contact spray were needed for control. The additional spraying, making a total of 11,260 gallons used for the year, was divided between the greenhouses and weed control. The sprayer has so far pumped 48,210 gallons since January, 1929. During December, 5,460 cuttings were inserted in the propagating house, consisting chiefly of the more unusual plants.

Almost an entire shipment of 1,273 trees and shrubs from the nurseries at the Arboretum, representing 126 varieties, was planted before freezing weather. An effort was made to bring all members of a genus together in a collection, in the belief that this will prove more interesting and educational than scattered plantings. One large bed near the mausoleum has been devoted to a collection of azaleas and kalmias; this bed also contains a specimen of Gordonia, probably the rarest tree in cultivation.

More than half the leaves this fall were raked directly on to shrubbery beds and spaded under, thus eliminating composting and double handling. About 225 loads of compost, collected from the greenhouses, etc., were hauled during the year. All the unused portion of the nursery was plowed and planted to soy beans for green manuring. Later this was planted to rye, which will be turned under during the spring.

Labels.—The proper labeling of trees and shrubs is always a problem. Quite apart from the actual removal or destruction of labels by thoughtless children or vandals the natural growth of a tree will, within a few years, cause the breaking

or detachment of many types of so-called "permanent" labels. This necessitates the use of a threaded bolt which every six months can be loosened, but even with such a precaution many cast labels are broken in a way which precludes their continued use. Copper strips have recently been substituted, on which the botanical and common name, with the native habitat, are stamped in raised letters by a machine. These are attached by a small square-headed brass bolt which can easily be loosened. Apparently these will remain legible for an indefinite period and should prove to be a most economical and satisfactory method.

The green pyralin labels, handwritten in India ink, for temporary naming of iris, roses, etc., will still be used, since these are not exposed during the winter and can be cleaned and revarnished for the next season, with the expenditure of little time or effort. Some 2,500 of these labels are now used, and in addition 5,000 copper or other stamped labels have been made during the year.

ATTENDANCE FOR THE YEAR 1932

(Recording turnstile count)

	Week-days	Sundays
January	11,724	18,486
February	9,197	7,500
March	12,736	16,214
April	13,403	14,497
May	21,154	24,288
June	15,844	9,797
July	18,270	9,236
August	21,798	12,148
September	18,308	11,043
October	18,912	23,928
November	20,185	30,846
December	5,646	5,201
	187,177	183,184
		187,177
Total		370,361

THE ARBORETUM (GRAY SUMMIT EXTENSION)

The planting and improvement of the Gray Summit property have advanced sufficiently to warrant it a more appropriate name than "Gray Summit Extension," which up to the present has been used. When the land was first acquired it was chiefly a collection of cornfields and there was no suitable designation for it. Now, however, with the extensive planting, the establishment of large nurseries, and other improvements, the place has begun to assume the appearance of an arboretum, and is destined within a short time to be a real collection of trees and shrubs hardy in this climate. Consequently (by action of the Board of Trustees) the name "Gray Summit Extension" is abandoned, and the property at Gray Summit is officially designated as the "Missouri Botanical Garden Arboretum." The city property will hereafter be known as "the Garden," with "the Arboretum" located in the country.

Only minor construction work was undertaken during the year 1932. The principal operations were confined to the grading of that portion of the pinetum east of the lake. This land, comprising about eight acres, had been very badly eroded. In addition to the necessary terracing some 3,000 square yards of sod were used on the gulleys after they had been filled to level. The whole area was manured, disked, and seeded. The grading of the section set aside for exotic plants was also completed. Some 400 feet of roadway has been graded and finished with gravel, and the necessary extension of the 15-foot drain under this roadway has been built. A new corncrib was erected on the property across the river, and the old house near the foreman's residence was put into usable condition.

The cherry, crabapple, and apple orchards have received the necessary pruning, spraying, mulching, etc., and the trees are all in good condition. In spite of the drouth they made a satisfactory growth, although some of the cherries and crabapples were rebudded. Over 1,000 conifers have been added in the pinetum and 800 trees and shrubs established in the new exotic section. The dogwood plantations have been augmented by the addition of 700 *Cornus florida* from

BOUQUET OF ORCHIDS PRESENTED TO THE QUEEN OF THE VEILED PROPHET BY THE GARDEN IN 1932

(Courtesy of St. Louis Post-Dispatch)

VANDA SANDERIANA FROM THE DWIGHT F. DAVIS ORCHID COLLECTION
(Two-thirds natural size)

(Courtesy of St. Louis Post-Dispatch)

the nursery, and a chestnut grove comprising 200 *Castanea dentata* and 100 *C. mollissima* has been established to the south of Brush Creek, in the hope that these trees may escape the chestnut blight.

In the rhododendron dell there have been added 600 *Azalea arborea,* 200 *A. mollis,* and 400 *Kalmia latifolia.* In this general vicinity there have also been planted 100 *Ilex glabra* and 50 *Cornus florida.* Nearly 60,000 narcissus bulbs, the gift of W. A. Rowe, were planted in the pinetum, as well as some 600 *Asclepias tuberosa,* the "butterfly weed." Some 1,500 trees and shrubs have been planted at various places on the grounds, and 500 dug and held in readiness for spring planting. As referred to elsewhere, the Arboretum has contributed to the city Garden nearly 1,300 trees and shrubs, making it possible to improve its appearance at a minimum expense.

In the nursery 875 linear feet of four-foot-wide seed-frames were seeded, and approximately 3,000 seedlings removed from the seed-beds into rows in the nursery. Over 4,000 young plants were transplanted from the upper to the lower nursery.

In the greenhouses, which are devoted almost exclusively to orchids, over 14,000 plants have been repotted and over 15,000 orchid flowers have been shown either in the city or in the alcove, where the rockery continues to be the most satisfactory means of displaying the potted plants in bloom.

A comparison of the number of hours of sunshine in St. Louis (at the Garden) and at the greenhouses at the Arboretum, obtained by the very accurate method of the Campbell-Stokes Sunshine Recorder, continues to be both interesting and instructive. The particular significance of the figures as given lies in the excess of sunlight outside the city during the winter months. From April until October there is invariably more sunlight than can be used by the plant, and shading of all greenhouses has to be resorted to. During the fall and winter months, however, absence of sunshine is invariably detrimental to plants, and prolonged cloudy periods may seriously affect their growth and blossoming. Consequently, the total number of hours of sunshine in a year at the Arboretum contrasted with that of St. Louis may

not be of much significance if the excess comes during the summer. It is because during the months of January, February, March, October, November, and December, 1932, there were 103½ hours more sunshine at Gray Summit than at the city Garden. Nearly 13 per cent more sunshine, at this critical time of year, must be one of the main factors in accounting for the very great advantage of growing plants at the out-of-town location.

HOURS OF SUNSHINE RECORDED IN 1932

Month	St. Louis	Gray Summit
January	96	119½
February	121½	136½
March	165½	179½
April	212	201
May	299½	290
June	238	265
July	301	312
August	289	285
September	231	241
October	218	235
November	132	146
December	96½	116½
	2400	2527
		2400
Difference		127

TROPICAL STATION, BALBOA, C. Z.

The appearance of the Station has changed more in the past year than in any previous twelve months of its existence. The high wire fence surrounding it has been replaced by a uniform hedge of low-growing crotons, which were planted some years ago in anticipation of the time when the old fence would have to be removed. Situated as it is in a rather obscure place the Station is not easily seen from the street, but with the new hedge the first impression is pleasing, and many visitors have agreed that it is one of the best kept and most beautiful spots on the Canal Zone.

The old slat house has been removed and replaced by a pipe and screen structure, which is not only more attractive

but is more durable and spacious. Practically all of the plants thrive better under the pipe racks with slat shade than on the old stands. The latter, however, have been repaired and kept in service where they permit of a better display of the plants.

Experiments in the use of native woods for the support of the orchids have been continued, but nothing more satisfactory than calabash has been found. In the future this wood will be used exclusively when available. Wherever possible plants have been brought in from the jungle on the wood on which they were found growing, but this wood soon goes to pieces and it is necessary to change to baskets or other wood. Transporting plants on their native wood involves extra labor, but this is repaid by their far greater exhibition value. Visitors are always interested in seeing plants in their natural state and overlook those of greater intrinsic value growing under artificial conditions.

A large number of plants placed on trees at the Station are doing very well, but to most people they are not so attractive as the jungle-grown plants. As a rule, baskets with peat packing have been the most satisfactory method of caring for the plants. They are more durable than blocks, do not easily become water-logged, and permit of rapid transplanting with least amount of damage. The use of pots has been continued only for those species which seem to be partial to them.

The past year has been no exception as regards the perpetual war on insect pests. Constant vigilance and the plentiful use of various poisons have held the damage as low as possible. The leaf-cutting ants still lead the list in causing the most damage. They seldom attack any of the orchids except the Sobralias, but are the ruination of all kinds of shade trees and ornamental shrubs.

Collecting trips made during the year extended into the foothills as far as fifty miles east of Panama City, and into the lake region on the northwest. As the Station is well stocked with all of the less rare sea-level orchids, only such plants were collected as were exceptionally desirable on account of size or condition, but note for future reference was made of all species found. One rarely encounters a large

number of orchids in any locality in Panama, and it is the exception when they are found in flower. Mr. Hunter, the resident manager, writes that twice this year he has had the pleasure of such an experience; the first was in a swampy patch of about ten acres of llano land on which there were thousands of plants of *Habenaria alata* in full flower. While the individual flowers are not particularly attractive, the sight of such a mass of Habenarias in bloom must have been a thrilling one. The second was a large patch of *Cattleya Deckeri* in full bloom. They were on low-growing trees and so could be reached easily from the ground. While this orchid is usually a rather shy bloomer, with a favorable season it is more gorgeous than any of the other smaller-flowered cattleyas. Many specimens had more than twenty flowers. A large bouquet of these flowers was presented to Mrs. Burgess, the wife of the retiring Governor of the Canal Zone, on the occasion of her departure. Because of the many courtesies received from Governor Burgess, it was a pleasure to present to Mrs. Burgess, on behalf of the Garden, this bouquet of native Panama flowers.

The imported Cattleyas from South America have bloomed as never before, more than a thousand blooms appearing in a period of about five months. This increase in flowers can only be attributed to the effectiveness of the new stands. Notable among the plants flowering for the first time this year were *Renanthera coccinea, Odontoglossum Powellii,* and *Cycnoches Warscewiczii.*

The natural growth of the palms and trees planted for shade has been very rapid, and considerable trimming was necessary during the wet season. This has resulted in an improved appearance of some of the less attractive spots at the Station.

ANNUAL BEQUESTS

The annual flower sermon, "On the wisdom and goodness of God as shown in the growth of flowers, fruits, and other products of the vegetable kingdom," provided for in the will of Henry Shaw, was preached at Christ Church Cathedral, on May 15, by Dr. Howard C. Robbins, of the

General Theological Seminary, formerly Dean of the Cathedral of St. John the Divine, in New York.

The Trustees' Banquet Fund and the Gardeners' Banquet Fund, inaugurated under the will of Henry Shaw, were not drawn upon during 1932.

The fund provided by Mr. Shaw for prizes at flower shows was expended for prizes given at the show of the St. Louis Flower Show Association, for the show of the St. Louis Horticultural Society, and, in part, for the new Henry Shaw Gold Medal.

RESEARCH AND INSTRUCTION

No resignations have been received nor new appointments made to the scientific staff.

Dr. J. M. Greenman, Curator of the Herbarium and Professor in the Henry Shaw School of Botany of Washington University, in addition to curatorial duties, has continued to direct the work of the graduate students in taxonomy. He has also continued his studies towards the publication of further parts of "A Monograph of the North and Central American Species of the Genus Senecio," "Studies of South American Senecios," and the preparations for a "Flora of the Southwest."

Dr. C. W. Dodge, Mycologist to the Garden and Professor in the Henry Shaw School of Botany of Washington University, has studied a disease of the Camellias, caused by *Alternaria Camelliae* or a closely related fungus, which has been very severe in the Linnean house during the past season. This organism injures the leaves and apparently causes the fall of the buds as they are about to open. He has also completed the manuscript of a book on the fungous diseases of man and other mammals, upon which he has been at work for the last decade. This work contains a wholly new classification of yeasts, both saprophytes and plant parasites as well as human pathogens, and a very complete monograph of the large group of fungi producing ringworm, athlete's foot, favus, etc. A survey of the lichen and fungous flora of Missouri is contemplated, and field work has been begun as opportunities have offered. It is hoped to extend this during the coming year as well as to complete a work on "The

Foliose and Fruticose Lichens of Costa Rica," and on "A Monograph of the Hymenogasteraceae," both of which manuscripts are nearly completed. Dr. Dodge, besides directing graduate work, has had charge of half the elementary course in plant morphology, and of the course in mycology at Washington University.

Dr. E. S. Reynolds, Physiologist to the Garden and Associate Professor in the Henry Shaw School of Botany of Washington University, has continued studies upon the toxicity of plant juices for fungi, with special emphasis upon the relative degrees of toxicity of different varieties and species of plants. New records of tree temperatures have been made. He has supervised the introductory course in elementary botany and conducted courses in introductory and advanced plant physiology, together with directing the work of the graduate students in this field. A paper on "Plant Physiology as Sachs Found It" was contributed to the Sachs celebration, and published in Ann. Mo. Bot. Gard. **19**: 3-14. 1932.

Dr. Robert E. Woodson, Jr., Research Assistant to the Garden and Instructor in the Henry Shaw School of Botany of Washington University, has been in charge of the laboratory in elementary botany, and conducted courses in elementary plant morphology and microtechnique. He has continued his taxonomic study of the American Echitoideae (Apocynaceae), as well as species of Tradescantia indigenous to the United States. Morphological studies of the stipules of the Contortae and the floral anatomy of the Apocynaceae are under way. Published articles include: "The Identity and Nomenclature of *Apocynum androsaemifolium.*" Rhodora **34**: 30-31. 1932; "New or Otherwise Noteworthy Apocynaceae of Tropical America. II." Ann. Mo. Bot. Gard. **19**: 45-76. 1932; "New or Otherwise Noteworthy Apocynaceae of Tropical America. III." Ann. Mo. Bot. Gard. **19**: 375-387. 1932.

Dr. Roland V. LaGarde, Research Assistant to the Garden and Instructor in Botany in the Henry Shaw School of Botany of Washington University, in cooperation with the School of Medicine, has conducted a course on general bacteriology, and assisted in the course on the morphology and

taxonomy of the algae. A study of the gum-decomposing organism was begun and minor investigations on the bacterial flora of ripe cantaloupes, wall-cleaning paste, etc., was completed.

The demand for a course in gardening by amateurs continues. Consequently this was again offered from January 12 to March 29. The change to an earlier date seemed advisable since the information given should be available in time for early spring planting. Eighty-eight registered for the course which included formal lectures and practical demonstrations.

The special course in gardening given to the students in the School of Occupational Therapy continued to be in charge of Miss Edith Mason.

Apprenticeships. — In the fortieth annual report of the Director (Mo. Bot. Gard. Bull., January, 1929) the development of instruction to gardeners, as provided for in Henry Shaw's will, was discussed in its various phases as conducted during the past forty years. The apprenticeship system now in vogue, which was adopted as meeting the greatest need, has proved most successful and more applications from all parts of the country are received than can possibly be taken care of. It should be borne in mind that the Garden has neither the funds nor the facilities for conducting an organized school. The teaching staff is necessarily made up of the regular Garden staff, who have other duties requiring a large proportion of their time. Consequently the number of apprentices is strictly limited by the nature of the various departments to which they are assigned. With the work extending over a period of at least three years, not more than two or three apprentices can be accepted each year, and there are times when no new appointments can be made. While the major portion of the training is practical, a system of lectures was introduced in the fall, covering such subjects as elementary botany, entomology, identification of plants, commercial floriculture, with a weekly review of floricultural and horticultural periodicals. Apprentices now enrolled are: P. Allen, J. W. Burton, L. Cutak, O. Haas, A. A. Knoll, G. D. Pring, W. Quest, and L. Rubinstein. Students who

during the year have received diplomas for the three-year course are: Charles F. Bessler, Cedric B. Flewellin, Norman Hintern-Esche, Harvey D. Peters, William L. Smith.

Graduates and Fellows.—The following appointments were made in the Henry Shaw School of Botany for the year 1932-33:

Assistants in Botany (half-time graduate students): Joseph C. Moore, B.S., Alabama Polytechnic Institute, Auburn, Ala. (Plant Physiology); Mary Elizabeth Pinkerton, B.S., University of Nebraska, Lincoln, Neb. (Taxonomy); F. Lyle Wynd, B.S., M.A., University of Oregon, Eugene, Ore. (Plant Physiology and Taxonomy).

Rufus J. Lackland Research Fellowships: George J. Goodman, A.B., University of Wyoming, Laramie, Wyo., M.S., Washington University (Taxonomy and Morphology); Morris Moore, B.S., Boston University, Boston, Mass., M.A., Harvard University, Cambridge, Mass. (Mycology and Physiology); Ward M. Sharp, M.S., University of West Virginia, Morgantown, West Va. (Taxonomy); Julian A. Steyermark, A.B., M.S., Washington University, A.M., Harvard University, Cambridge, Mass. (Taxonomy).

Fellowship in American Creosoting Company: Earl E. Berkley, A.B., University of West Virginia, Morgantown, West Va., M.S., Washington University (Plant Physiology and Chemistry).

Independent Students: Ruth Cornelius, A.B., Washington University (Taxonomy and Morphology); Maxine Larisey, A.B., Washington University (Taxonomy); Esther L. Larsen, A.B., University of Montana, Missoula, Mont., M.S., Washington University (Taxonomy).

Degrees.—The following graduate students in the Henry Shaw School of Botany received advanced degrees at the Washington University commencement, June 9, 1931: Doctors of Philosophy—Caroline K. Allen, Harry J. Fuller, and Lily M. Perry; Master of Science—Mary Ledgerwood Fuller, Dorothy Megowen Berkley, and Mary Elizabeth Pinkerton.

Published Articles.—

Child, Marion. The Genus Daldinia. Ann. Mo. Bot. Gard. **19**: 429-496. 1932.

Fuller, Harry J. The Injurious Effects of Ultra-Violet and Infra-Red Radiations on Plants. Ann. Mo. Bot. Gard. **19**: 79-86. 1932.

Fuller, Harry J. Some Effects of Radiations from a Mercury Vapor Arc in Quartz upon Enzymes. Ann. Mo. Bot. Gard. **19**: 505-531. 1932.

Goodman, George J. A Collection of Emex from California. Leaflets West. Bot. **1**: 21. 1932.

Goodman, George J. A New Nama from Idaho. Ann. Mo. Bot. Gard. **19**: 177-178. 1932.

Goodman, George J., and C. Leo Hitchcock. A New Scapose Draba from Utah. Ann. Mo. Bot. Gard. **19**: 77-78. 1932.

Hitchcock, Charles Leo. A Monographic Study of the Genus Lycium of the Western Hemisphere. Ann. Mo. Bot. Gard. **19**: 179-374. 1932.

Jensen, L. P. Arboricultural Development in the Missouri Botanical Garden. Parks and Recreation **15**: 264-270. 1932.

Jensen, L. P. Ozarks are a Wild-Flower Paradise. Blue Diamond (publication Kansas City Athletic Club) **27**: 14-17. 1932.

Jensen, L. P. Protect Wild Flowers of the Ozarks. Missouri **4**: 6-8. 1932.

Jensen, L. P. Roadside Beautification in Missouri. Parks and Recreation **15**: 409-413. 1932.

Jensen, L. P. Shaw's Garden Outgrows Its Borders. Missouri **4**: 22-23. 1932.

Jensen, L. P. The Cultivated Phloxes. Garden Life **5**[4]: 7-8. 1932.

Mathias, Mildred E. Studies in the Umbelliferae. IV. Ann. Mo. Bot. Gard. **19**: 497-498. 1932.

Moore, John Adam. A New Species of Parmelia from Texas. Ann. Mo. Bot. Gard. **19**: 503-504. 1932.

Moore, Morris. Coccidioidal granuloma: A Classification of the Causative Agent, *Coccidioides immitis*. Ann. Mo. Bot. Gard. **19**: 397-428. 1932.

Pring, George H. The Lost Yellow Lily. Ladies' Home Journal **49**: 19, 112. 1932.

Reynolds, Ernest S. Plant Physiology as Sachs Found It. Ann. Mo. Bot. Gard. **19**: 3-14. 1932.

Steyermark, Julian A. A Revision of the Genus Menodora. Ann. Mo. Bot. Gard. **19**: 87-116. 1932.

Steyermark, Julian A. Some New Spermatophytes from Texas. Ann. Mo. Bot. Gard. **19**: 389-395. 1932.

Woodson, Robert E., Jr. Identity and nomenclature of *Apocynum androsaemifolium*. Rhodora **34**: 30-31. 1932.

Woodson, Robert E., Jr. New or Otherwise Noteworthy Apocynaceae of Tropical America. II. Ann. Mo. Bot. Gard. **19**: 45-76. 1932.

Woodson, Robert E., Jr. New or Otherwise Noteworthy Apocynaceae of Tropical America. III. Ann. Mo. Bot. Gard. **19**: 375-387. 1932.

Wynd, F. Lyle. An Apparatus for the Determination of Carbon Dioxide Production of Physiological Plant Studies. Ann. Mo. Bot. Gard. **19**: 497-498. 1932.

Scientific and Popular Lectures.—

Carroll W. Dodge, Mycologist to the Garden: April 8, bacteriological seminar at Washington University Medical School, "Pathogenic Yeasts"; December 20, biological society of Phi Sigma, "Fungi Producing Ringworm."

L. P. Jensen, Manager of the Arboretum: February 19, Eureka Beautification Club, Eureka, Mo., "How to Plan and Plant Your Yard"; March 1, Greater St. Louis Association of Gardeners, Kirkwood, Mo., "The Gardener's Interest in Roadside Planting"; March 21, Glendale Garden Club, "The Wild Flowers of Spring"; April 12, Warrenton Garden Club, Warrenton, Mo., "Planting of the Home Grounds"; May 3, Kirkwood Garden Club No. 1, "Wild Flowers"; June 13, Federation of Evangelical Brotherhoods of St. Louis, "The History of Landscape Art"; August 20, U. S. Department of Agriculture Club, and September 4, Greater St. Louis Association of Gardeners, "The Gray Summit Extension";

November 14, Garden Club of Gray Summit, "Why We Should Have a Garden Contest."

Paul A. Kohl, Floriculturist to the Garden: March 1, radio talk over Station KWK, "Annuals and Perennials."

George T. Moore, Director of the Garden: February 3, Citizens' Smoke Abatement League,"Effect of Smoke on Plants"; February 23, Executives Club of St. Louis, "Advertising St. Louis with Flowers"; March 7, Engineers Club of Kansas City, "Movement in Plants"; March 20, radio talk over Station KMOX, "The Easter Lily: Its History and Development"; April 4, garden clubs of Franklin County, "Some Inside Facts about Plants"; April 8, Home Economics and Arts Club, "Morality in Plants"; May 31, Exchange Club, at the Hotel Claridge, "Henry Shaw and his Contribution to St. Louis' Progress"; June 1, educational group of Y. M. H. A. and Y. W. H. A., "Intelligence in Plants"; June 3, St. Louis Horticultural Society, "What Goes On Inside the Plant"; June 8, annual meeting Moorlands Addition Improvement Association, "The Effect of Smoke on Plant Life"; July 14, Kiwanis Club, "What St. Louis Owes to Henry Shaw"; July 20, South Side Optimists' Club, "Advertising St. Louis with Flowers"; September 7, St. Louis Lions Club, "Henry Shaw and His Garden"; September 13, "X" Club, "St. Louis and Its Garden"; October 12, Scottish Rite Club of St. Louis, "Why People Visit Shaw's Garden."

G. H. Pring, Superintendent of the Garden: January 26, Quest Club, "The Development of the Orchid"; February 4, department of horticulture, University of Illinois, "Glass Gardens"; February 5, St. Louis Horticultural Society, "The Royal Botanic Gardens, Kew"; March 1, radio talk over Station KWK, "Spring Work in the Garden"; March 9, science department of the Normandy High School, "Plant Exploration in the Andes"; March 21, Missouri State Nurses' Organization, and March 28, Woman's Club of Belleville, Illinois, "The Monthly Floral Displays at the Garden"; March 30, St. Louis Co-operative Club, "Spring Gardening"; April 5, Webster Groves Chapter Daughters American Revolution, "Colonial Gardens"; April 12, radio talk over Station KMOX, "Clean Up, Plant Up St. Louis"; April 13, Town Club of St. Louis, "Wardian-Case Gardens"; April 27, P. E.

O., "Orchid Exploration in the Andes"; May 4, Cleveland High School, "Before and After Planting"; May 16, radio talk over Station KWK, "Water-lilies for St. Louis"; May 17, South Side Exchange Club, "Plants of Interest"; May 20, Friday Club, "Flowers and Insects"; June 15, Missouri and Illinois Cemetery Officials, "Experiments with Grasses Suitable for Lawns"; September 9, United States Department of Agriculture Club, "The Activities of the Missouri Botanical Garden"; October 7, Town Club, "Orchids"; October 25, Carondelet Y. W. C. A., "Wardian-Case Gardens"; October 27, Concordia Patrons' Association, "What to Plant in Your Garden."

Hermann von Schrenk, Pathologist to the Garden: March 17, University of Illinois, Urbana, Ill., "Experiences of a Timber Engineer"; April 7, Engineers' Club of St. Louis, "Termites"; May 18, National Association of Railway Tie Producers, Memphis, Tenn., "Some Comparisons of the Different Species of Tie Timbers"; November 17, in a symposium before the American Society for Testing Materials, New York, "Timber."

Robert E. Woodson, Jr., Research Assistant to the Garden: December 2, St. Louis Horticultural Society, "New Plants for St. Louis."

HERBARIUM

Work in the herbarium has gone forward steadily throughout the year. New and important series of specimens have been acquired which supplement substantially the Garden collections, maintaining a well-balanced representation of the world-flora, with particular emphasis on America and more especially to the flora of the southwestern part of the United States.

New Accessions.—The larger and more important collections obtained during the year are the following: P. Aellen, 100 plants of Switzerland; Arnold Arboretum, 799 plants of the United States, collected by E. J. Palmer; W. E. Broadway, 610 plants of Trinidad and Tobago, British West Indies; B. F. Bush, 75 plants of Missouri; California Academy of Sciences, 225 plants of western United States and Mexico; R. Ciferri, 120 fungi of the Dominican Republic; Conserva-

toire et Jardin Botanique, Geneva, Switzerland, 166 plants of southern Europe; D. Demaree, 1,309 plants of Arkansas and California; C. W. Dodge, 83 plants of Missouri, Louisiana, and Costa Rica; L. M. Dougan, 215 plants of the United States; J. Ewan, 40 plants of California; Field Museum of Natural History, Chicago, 241 plants, mostly of the United States and Central America; H. A. Gleason, 389 plants of Brazil; G. J. Goodman, 133 plants of Wyoming and Utah; F. W. Gray, 100 lichens of West Virginia and North Carolina; H. Gunkel, 100 plants of Chile; B. Harrison, 232 plants of western United States; C. L. Hitchcock, 550 plants, mostly of California; M. E. Jones, 235 plants of southwestern United States and Mexico; P. Jörgensen, 167 plants of Paraguay; Karls University, Prague, 100 plants of Czechoslovakia; J. H. Kellogg, 88 plants of Missouri; C. L. Lundell, 379 plants of Yucatan; B. Lynge, 95 lichens of northeastern Greenland; Masaryk University, Brno, 100 plants of Czechoslovakia; Mrs. F. A. MacFadden, 636 hepatics and mosses of British Columbia and Alberta; G. M. Merrill, 70 plants of Arkansas; Mrs. Ynes Mexia, 637 plants of Mexico and Brazil; C. E. Moore, 120 plants of eastern Tennessee; J. A. Moore, 212 plants of western United States; J. A. Moore and J. A. Steyermark, 540 plants, chiefly of Texas; Museum of Natural History, Vienna, 162 plants of Europe; Philadelphia Academy of Natural Sciences, 66 plants of New Jersey; Elizabeth Pinkerton, 80 plants, mostly of Missouri; B. Rambo, 100 lichens of Brazil; Riksmuseets, Botaniska Avdelning, Stockholm, 300 plants of Sweden and the West Indies; W. A. Schipp, 237 plants of British Honduras; W. M. Sharp, 63 plants of Virginia, North Carolina, and Tennessee; F. L. Stevens, 180 plants of the Philippine Islands and tropical America; J. A. Steyermark, 1,155 plants of eastern and central United States; L. Suppan, 175 plants of the Philippine Islands; H. Sydow, 150 fungi; B. C. Tharp, 330 plants of Texas; J. W. Thompson, 865 plants of Washington; University of California, 501 plants of California; University of Minnesota, 99 plants of Minnesota, and 615 fungi, mainly of South America; University of Missouri, 60 plants of Missouri; U. S. Department of Agriculture, 80 fungi; U. S. National Museum, 850 plants of the United

States, West Indies, South America, and China; E. J. Valeur, 146 plants of Santo Domingo; Fr. Verdoorn, 150 hepatics and mosses; Theo. Oswald Weigel, 495 plants, chiefly of the West Indies and South America; L. Williams, 720 plants of Wyoming and Utah. Many smaller collections have been received from correspondents and friends of the Garden. A complete record of accessions has been made in the current numbers of the BULLETIN for 1932.

This enumeration shows that the herbarium has been augmented by specimens from various parts of the Western Hemisphere from Greenland to Chile, as well as from many countries of the Old World. This new material represents particularly all larger groups of plants. It is also worthy of note that numerous photographs of types and historical specimens of great scientific value have been obtained and added to the permanent collections.

Mounting and Inserting of Specimens.—The mounting of specimens has kept apace with the acquisition of new material. It has been possible, moreover, not only to mount the material received on current accessions but also over two thousand specimens which have accrued from previous years. Thus, there have been mounted and incorporated with the general collections during the year 19,036 sheets.

Exchanges.—An important source for the acquisition of material for the herbarium is through exchanges. In this manner 4,568 specimens have been obtained during the fiscal year; and during the same period of time 3,962 duplicate herbarium specimens have been sent to correspondents and to other herbaria.

Distribution and Reorganization of Specimens.—Distribution of newly mounted specimens has followed closely the work of mounting. The reorganization of material already in the herbarium has been advanced as rapidly as possible with the small herbarium staff. To this necessary work the Curator has devoted a large part of his time. In the distribution of specimens and in the work of reorganization the more advanced graduate students in taxonomy have rendered valuable assistance.

Field Work.—Only a limited amount of field work has been carried on during the year. Graduate students and friends of the Garden, however, have made numerous but small gifts which substantially augment our representation of the local flora.

Use of the Herbarium.—It is gratifying to note the ever-increasing use of the herbarium. In addition to the members of the staff, the graduate students, local and out-of-town botanists, who are constantly consulting the collections, there have been numerous requests by mail from all parts of the country for accurate identification of indigenous and cultivated plants. Several loans of herbarium specimens have been made to facilitate the work of specialists and monographers in different parts of the country. Incidentally, it may be mentioned that the growing custom of inter-herbarium loans has done much to advance research in the field of taxonomy as well as to promote the spirit of coöperation among American and foreign botanical institutions.

Statistical Summary (For the year ending December 31, 1932):

Number of specimens acquired on new accessions:

By purchase	**10,474**	
By gift	**1,906**	
By exchange	**4,568**	
By transfer	**14**	
By field work	**49**	
Total	**17,011**	**valued at $2,126.38**
Number of specimens mounted and incorporated	**19,036**	**valued at 3,807.20**
Number of specimens discarded from the herbarium	**27**	**without value**
Number of specimens in organized herbarium	**1,031,218**	**valued at $167,874.00**
Number of specimens in unorganized herbarium	**86,109**	**valued at 8,610.90**
Wood specimens, etc., in herbarium		**valued at 280.00**
Microscope slides		**valued at 450.00**
Total valuation		**$177,214.90**

LIBRARY AND PUBLICATIONS

The average number of books and pamphlets has been added to the library during 1932. However, the majority of these were received as gifts or in exchange for the Garden publications. The book catalogues have contained more than a usual number of attractive offerings, but except when absolutely needed advantage was not taken of them. Dr. E. A. Burt, formerly the mycologist and librarian, before disposing of his private library, gave the Garden the opportunity of purchasing some of the rare mycological works, and the library was thus able to secure Fries' "Monographia Hymenomycetum Sueciae," Persoon's "Observationes Mycologicae," Persoon's "Commentatio de Fungis," Quelet's "Champignons du Jura et Vosges," Quelet's "Flore Mycologique de la France"; and Vittadiní's "Monographia Lycoperdineorum," and several others. Perhaps the most noteworthy purchase of the year was the subscription to Zahlbruckner's "Catalogus Lichenum Universalis," of which eight volumes have already been published. Through the activity of Mr. Gurney Wilson, the Garden's European representative, numerous horticultural works, especially old English seed catalogues, have been received. An important acquisition was the gift by Dr. Hermann von Schrenk, Pathologist to the Garden, of hundreds of bulletins and reprints from his private library. The collection is still unorganized, and while it doubtless contains many papers duplicated in the Garden library there are also many which will be extremely valuable.

Recently the books in the folio room had become extremely congested, and before the purchase of the thirteen volumes of Velloso's "Flora Fluminensis" in 1931, the last available space had been filled. Accordingly in 1932 new shelves were built on the north wall, and constructed so that these and other valuable folios could be laid flat and kept in better condition. In order to provide room for new accessions the library is gradually discarding old serials unrelated to botany or ones which might be easily obtained in the city. During the year 141 volumes and 355 pamphlets, representing chiefly census reports, geological papers, or pedagogical

publications, were either returned to the government printing office or placed in a lot to be sold later.

In April the two bookbinders employed each year for repairing books, spent two weeks in the library, during which time 705 books were repaired or oiled.

In July about 1200 reprints from the ANNALS were mailed to 250 botanists in this country and abroad in exchange for their publications.

Use of the Library.—Besides the staff and students of the Shaw School of Botany the following botanists have made use of the resources of the library during the year: Dr. Edgar Anderson, arborist, Arnold Arboretum of Harvard University, Jamaica Plain, Mass.; Mr. E. G. Barrett, of the Illinois State Natural History Survey; Mr. O. T. Bonnett, instructor in botany, University of Illinois, Urbana, Ill.; Dr. Margaret B. Church, mycologist, Urbana University, Urbana, Ohio; Mr. Francis Drouet, graduate assistant in botany, University of Missouri, Columbia, Mo.; Prof. H. I. Featherly, associate professor of botany and plant pathology, Oklahoma Agricultural and Mechanical College, Stillwater, Okla.; Mr. T. H. Frison, Chief Illinois Natural History Survey; Dr. Harry J. Fuller, instructor in botany, University of Illinois, Urbana, Ill.; Prof. and Mrs. Bertrand F. Harrison, of Brigham Young University, Provo, Utah; Miss Ada Hayden, assistant professor of botany, Iowa State College, Ames, Iowa; Dr. Grace E. Howard, assistant professor of botany, Wellesley College, Wellesley, Mass.; Mr. William H. Judd, propagator, Arnold Arboretum of Harvard University, Jamaica Plain, Mass.; Dr. Theodor Just, assistant curator, Greene Herbarium, University of Notre Dame, Notre Dame, Ind.; Dr. T. H. Kearney, principal physiologist, Bureau of Plant Industry, U. S. Dept. Agr., Washington, D. C.; Miss Catharine M. Lieneman, instructor in botany, North Carolina College for Women, Greensboro, N. C.; Dr. Mildred E. Mathias, research associate, New York Botanical Garden; Dr. D. T. MacDougal, research associate, Desert Laboratory, Carnegie Institution of Washington, Tucson, Ariz.; Mr. C. E. Moore, professor of biology, State Teachers College, Memphis, Tenn.; Dr. H. S. Pepoon, of the Illinois State Natural His-

tory Survey; Prof. W. O. Richtmann, associate professor of pharmacy, University of Wisconsin, Madison, Wis.; Prof. H. W. Rickett, associate professor of botany, University of Missouri, Columbia, Mo.; Mr. Donald P. Rogers, graduate student in botany, University of Iowa, Iowa City, Iowa; Dr. Carl E. Sherff, of the Field Museum of Natural History, and head, department of science, Chicago Normal College, Chicago, Ill.; Dr. Henry Schmitz, professor of forestry, University of Minnesota, St. Paul, Minn.; Dr. Georg Tischler, professor of botany, Christian-Albrechts University, and director of the Botanical Institute and Gardens, Kiel, Germany; Dr. N. I. Vavilov, director of the Institute of Applied Botany, Leningrad, U. S. S. R.; Prof. A. G. Vestal, associate professor of botany, University of Illinois, Urbana, Ill.; Dr. Marie Victorin, head of the department of botany, Université de Montreal, Montreal, Canada.

In addition, Prof. H. W. Rickett, associate professor of botany, University of Missouri, Columbia, Mo., accompanied his class in botany from that institution on a visit to the library and herbarium, as did Miss Minnie M. Johnson, teacher of botany, Stephens College, Columbia, Mo., and Dr. E. R. Spencer, professor of botany, McKendree College, Lebanon, Illinois. Also, the students from the St. Louis College of Pharmacy have consulted the library frequently in working up their studies of some particular drug plant.

Out-of-town botanists also have the privilege of borrowing books on the inter-library loan plan. One hundred such loans were made to 37 institutions during the year.

Garden Publications.—Volume XIX of the ANNALS OF THE MISSOURI BOTANICAL GARDEN, consisting of 538 pages, 34 plates, and 14 text-figures, was published during the year. The monthly BULLETIN (Vol. XX) was also completed and comprises 172 pages and 49 plates. The cash receipts during the year from the sale of ANNALS, BULLETINS, reprints, BOOKS OF VIEWS, etc., was $1,761.99. Both ANNALS and BULLETIN are sent in exchange for other publications; 418 foreign institutions and 121 domestic ones sending the Garden their publications in exchange for the ANNALS, and

47 foreign and 48 domestic institutions being on the exchange list for the BULLETIN.

The Garden BULLETIN continues to have a wide public appeal, as evidenced by the number of articles reprinted or abstracted in other journals, some of which are listed below:

Horticulture
Parks and Recreation
National Horticultural Magazine
Garden Digest
Florists' Review
National Druggist
Orchid Review
Missouri Magazine
Journal New York Botanical Garden
Florists' Exchange
Texas Technological Bulletin
Desert
Southern Florist
Science News Letter
Flower Grower
Bulletin Ohio Flower Growers and Retailers Association
La Reforma Medica
Cactus and Succulent Journal

New Accessions.—The following are some of the noteworthy accessions received during the year: Alexandrow, Russian Dictionary, 2 vols.; Annales de cryptogamie exotique, vols. 1-5; Annual review of biochemistry, vol. 1; Barla, Champignons des Alpes-maritimes; Berkeley, Outlines of British fungology; Botanisches Taschenbuch für die Anfänger dieser Wissenschaften u. d. Apothekerkunst, 1790-1804; Bresadola, Iconographia mycologica, vols. 19-22; Brown, Tischer, and Karsten, Mesembryanthema; Buller, Researches on fungi, vol. 4; Burtt-Davy, Manual of the flowering plants and ferns of the Transvaal, vol. 2; Colla, Hortus ripulensis, 1824; Colloid Chemistry, vol. 3; Conifers in cultivation (report Conifer Conference held by Royal Horticultural Society); Correa, Diccionario das plantas uteis do Brazil, vol. 2; Cunningham, The rust fungi of New Zealand; Desfontaines, Des genres des plantes (copy of original and unpublished mss. in Bibl. Mus. Hist. 1799); Diels, Beiträge zur Kenntnis d. Vegetation u. Flora d. Seychellen; Ellis, Sulphur bacteria; Encyclopédie mycologique, vol. 1, Le genre Inocybe; Ergebnisse der Enzymforschung, vol. 1; Engler, Das Pflanzenreich, Hefte 98 A, B, C, D, 99; Ernst et Vajda, Flora photographica Hungariae, vol. 2, pts. 2-6; Fries, Monographia Hymenomycetum Sueciae; Fries, Ofversigt af Wäxt Rikets Naturliga Familjer. 1835 (mss. notes

on lectures written by G. Forssell); Goebel, Organographie der Pflanzen, 3 Aufl., 3 Teil, 1. Hälfte; Hermannus, Horti Academici Lugduno-Batavi catalogus; Höhnel, Mykologische Schriften; Huber, Arboretum amazonicum, 1-4; International critical tables, vols. 6-7; Karsten, Icones selectae Hymenomycetum Fennicae; King and Gamble, Materials for a flora of the Malayan Peninsula, vol. 4; Klein, Handbuch der Pflanzenanalyse, vol. 2, part 1; Konrad and Maublanc, Icones selectae fungorum, vols. 6-7; Lockwood, Gardens of colony and state; Lundegardh, Die Nährstoffaufnahme der Pflanze; Magazin für das neueste aus d. Physik u. Naturgeschichte; Marloth, The flora of South Africa, vol. 3; Mangin, Travaux cryptogamiques dédiés à L. Mangin; Masson, Stapeliae novae; Nelson, Die Orchideen Deutschlands und der angrenzenden Gebiete; Niklas, Czibulka and Hock, A bibliographical list of the entire domain of agricultural chemistry, vols. 1-2; Perkins, Fragmenta florae Philippinae, vols. 1-3; Persoon, Commentatio de fungis; Pulle, Flora Surinam, parts of vols. 2, 3, 4; Persoon, Observationes Mycologicae; Quelet, Champignons du Jura et Vosges, with supplements; Quelet, Flore mycologique de la France; Rawitscher, Der Geotropismus der Pflanzen; Richon and Roze, Atlas champignons, 2 vols.; Rydberg, Flora of the prairies and plains of Central North America; Schrader, Nova Genera plantarum, vol. 1. 1797; Sorauer, Handbuch der Pflanzenkrankheiten, 4th ed., vol. 4, pt. 1, vol. 5, pt. 2, 5th ed., vol. 3; Stillwell, Incunabula and Americana; Trautvetter, Plantarum imagines et descriptiones floram Russicam. fasc. 1-8; Tschirch, Handbuch der Pharmakognosie, 2 Aufl., pts. 3-10; Tulasne et Tulasne, Selecta fungorum carpologia; Vittadini, Monographia Lycoperdineorum; Watt and Breyer-Brandwijk, The medicinal and poisonous plants of southern Africa; Zahlbruckner, Catalogus lichenum universalis, vols. 1-8.

Statistical Information.—There have been donated to the library or received in exchange during the year 642 books valued at $1,419.93, and 2,455 pamphlets valued at $514.20. Three hundred and ninety-one books were bought at a cost of $2,852.94, and 153 pamphlets at a cost of $179.74. One hundred and forty-one books and 355 pamphlets were dis-

carded from the library, valued at $385.98. The library now contains 47,658 books and 72,735 pamphlets. There are 332 manuscripts valued at $1,621.80, and 1,001,882 index cards valued at $12,119.53. A total of 11,537 cards were added during the year, of which 1,692 were written by Garden employees, and 9,845 were purchased at a cost of $188.07. Two hundred and eighty-nine books were bound and 705 repaired. Fifty-three maps were bought at a cost of $3.32.

GEORGE T. MOORE,
Director.

STATISTICAL INFORMATION FOR DECEMBER, 1932

GARDEN ATTENDANCE:

Total number of visitors.....10,847

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought.....	11
Total number of books and pamphlets donated.....	169

PLANT ACCESSIONS:

Total number of plants and seed packets donated.....	45
Total number of bulbs donated	4,915

HERBARIUM ACCESSIONS:

By Purchase—

Broadway, W. E.—Plants of Trinidad and Tobago.....	102
Demaree, Professor Delzie—Plants of Arkansas.....	327
Gleason, Dr. H. A.—Plants of Brazil, collected by B. A. Krukoff	389
Hitchcock, Dr. Charles Leo—Plants of western United States, chiefly California.....	550
Museum of Natural History, Paris—Photographs of herbarium specimens.....	3
Royal Botanic Gardens, Kew—Photographs of herbarium specimens	2
Thompson, Professor J. William—Plants of Washington	203
Williams, Louis—Plants of Wyoming and Utah.....	625

By Gift—

Clark, Ora M.—Plants of western United States.....	27
Dougan, Professor L. M.—Plants of the United States..	215
Steyermark, Julian A.—Hepatics of Missouri.....	8

By Exchange—

Botanical Garden, Berlin—Photograph of herbarium specimen	1
Botanical Institute, Charles University, Prague—"Flora Cechoslovenica exsiccata" Cent. III, Nos. 201-300, inclusive	100
Demaree, Professor Delzie—Plants of Arkansas.....	327
U. S. National Museum—Plants of Arizona.....	2
University of Missouri, by Dr. Francis Drouet—Plants of Missouri	60
Total	2,941

SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date to the death of Mr. Shaw, in 1889, the Garden was maintained under the personal direction of its founder, and, while virtually a private garden, it was, except at certain stated times, always open to the public. Although popularly known as "Shaw's Garden" the name Missouri Botanical Garden was designated by Mr. Shaw as its official title and in his will or in any of his writings he specifically referred to it as the "Missouri Botanical Garden." By a provision of Mr. Shaw's will the Garden passed at his death into the hands of a Board of Trustees. The original members of the Board were designated in the will, and the Board so constituted, exclusive of certain ex-officio members, is self-perpetuating. By a further provision of the will, the immediate direction of the Garden is vested in a Director, appointed by the Board of Trustees. The Garden receives no income from city or state, but is supported entirely from funds left by the founder.

The city Garden comprises 75 acres, where about 12,000 species of plants are growing. There is now in process of development a tract of land of over 1,500 acres outside the city limits which is to be devoted to (1) the propagation and growing of plants, trees, and shrubs, designed for showing either indoors or outside, at the city Garden, thus avoiding the existing difficulties of growing plants in the city atmosphere; (2) gradually establishing an arboretum as well as holding a certain area as a forest reservation, with the idea that possibly at some future time this may become the new botanical garden.

The Garden is open to the public every day in the year, except New Year's Day and Christmas—week days from 8:00 a. m. until one-half hour after sunset; Sundays from 10 a. m. until sunset.

The main entrance to the Garden is located at Tower Grove Avenue and Flora Place, on the Sarah car line (No. 42). Transfer south from all intersecting lines. The Garden may also be reached by Bus Route No. 12, to which all other motor-bus lines transfer.

STAFF
OF THE MISSOURI BOTANICAL GARDEN

GEORGE T. MOORE,
Director

KATHERINE H. LEIGH,
Assistant to the Director

HERMANN VON SCHRENK,
Pathologist

CARROLL W. DODGE,
Mycologist

JESSE M. GREENMAN,
Curator of Herbarium

ROLAND V. LAGARDE,
Research Assistant

ERNEST S. REYNOLDS,
Physiologist

ROBERT E. WOODSON, JR.,
Research Assistant

NELL C. HORNER,
Librarian and Editor of Publications

GEORGE H. PRING,
Superintendent

JOHN NOYES,
Consulting Landscape Architect

PAUL A. KOHL,
Floriculturist

W. F. LANGAN,
Chief Engineer

A. P. BEILMANN,
Arboriculturist

J. H. KELLOGG,
Plant Collector

J. CUTAK,
In charge Exotics

J. LANGAN,
Assistant Engineer

A. D. FORRESTER,
Plant Recorder

A. PEARSON,
Painter

ARBORETUM

L. P. JENSEN,
Manager

G. GOEDEKE,
Foreman

D. MILLER,
Orchid Grower

R. E. KISSECK,
Engineer

TROPICAL STATION, BALBOA, CANAL ZONE

A. A. HUNTER,
Manager

REPRESENTATIVE IN EUROPE

GURNEY WILSON, F. L. S.

MISSOURI BOTANICAL GARDEN BULLETIN

Vol. XXI FEBRUARY, 1933 No. 2

CONTENTS

Page

New or Noteworthy Plants for St. Louis:
I. × Crinodonna Corsii (Amarcrinum Howardii) . . 37
New or Noteworthy Plants for St. Louis: II. Tithonia speciosa (Showy Mexican Sunflower) 40
Growing Succulents from Seed in the Home 41
Plants that Produce Light 42
Notes 46
Statistical Information 47

ST. LOUIS, MO.
1933

Published Monthly, Except July and August, by the Board of Trustees

SUBSCRIPTION PRICE:

ONE DOLLAR PER YEAR SINGLE COPIES TEN CENTS

BOARD OF TRUSTEES
OF THE MISSOURI BOTANICAL GARDEN

THE ORIGINAL MEMBERS WERE DESIGNATED IN MR. SHAW'S WILL AND THE BOARD SO CONSTITUTED, EXCLUSIVE OF THE *EX-OFFICIO* MEMBERS, IS SELF-PERPETUATING

President
GEORGE C. HITCHCOCK

Vice-President
SAMUEL C. DAVIS

Second Vice-President
DANIEL K. CATLIN

L. RAY CARTER

THOMAS S. MAFFITT

GEORGE T. MOORE

ALBERT T. PERKINS

EUGENE PETTUS

ETHAN A. H. SHEPLEY

FRED G. ZEIBIG

EX-OFFICIO MEMBERS

GEORGE R. THROOP,
Chancellor of Washington University

FREDERICK F. JOHNSON,
Bishop of the Diocese of Missouri

VICTOR J. MILLER,
Mayor of the City of St. Louis

JOHN J. LICHTER,
President of The Academy of Science of St. Louis

MYRT A. ROLLINS
President of the Board of Education of St. Louis

Secretary
GEORGE F. HEFFERNAN

× CRINODONNA CORSII

Missouri Botanical Garden Bulletin

Vol. XXI FEBRUARY, 1933 No. 2

NEW OR NOTEWORTHY PLANTS FOR ST. LOUIS. I.

×CRINODONNA CORSII (AMARCRINUM HOWARDII) GARDEN HYBRID

This most interesting bigeneric hybrid of garden origin flowered for the first time at the Garden on October 3, from dormant bulbs obtained from California during December, 1931. Hybrids between Amaryllis and allied genera, as Brunsvigia and Lycoris, have been known for many years, but this plant represents a new combination, which, strange to say, was produced simultaneously in Italy and in California. However, the Italian account by Dr. Attilio Ragionieri of Castello, Italy, antedates by four years the American one. In the English "Gardeners' Chronicle," January 15th, 1921, he described this new beautiful pink-flowered hybrid, the result of crossing *Amaryllis Belladonna* with the pollen of *Crinum Moorei*. This had netted him four fertile seeds, which were carefully sown and guarded with the utmost care. Four plants were successfully raised, the first one flowering in 1915. His account in the "Gardeners' Chronicle" states:

"Botanists will perhaps not deal too harshly with the creation of a new genus for this bigeneric Amaryllidaceous hybrid..... The illustration represents the original specimen (spoiled by a wind storm), upon which the following description has been made:

"CRINDONNA MEMORIA CORSII.—New hybrid: Plant evergreen, the chief period of vegetation occurring at the end of summer. Bulb—8-9 cm. in diameter, ovoid, with rather fibrous tunic, plentifully proliferous, with a neck about 15 cm. long. Leaves—10-12 to a bulb, drooping sometimes, showing a tendency to be distichous, dark

green, more or less carinate, 3-4 cm. broad, 70-90 cm. long. Peduncle —stout, compressed, green, with a purplish tone at the base, lightly glaucous, 50 cm. long. Spathe valves—about 13 cm. long, 3 cm. broad, with a rose-coloured stripe occupying the third central portion in its whole length. Flowers—8-12 in an umbel, 18 cm. long, including the pedicel, 10 cm. broad. Perianth with a slightly curved tube, 14 cm. long; segments acuminate, the three external ones 2 cm. broad, the interior ones 3 cm.; colour pinkish-rose, more deep in the center of the segments and at their apex. Filaments—shorter than the corolla and of the same colour. Anthers—linear. Style—rather shorter than the perianth, colour dark rose-pink. Stigma—trifid. Flowering time—August.

"I have dedicated this new hybrid to the venerated memory of the late Marquis Bardo Corsi Salvati, of Florence, the enthusiastic and very intelligent lover of fine plants, who had formed in his gardens at Sesto the most complete collection of stove and other plants in Italy. Dr. Odoardo Beccari, the eminent Palmologist, of Florence, had sent him, during his journey at the Sunda Isles, many new plants and seeds that completed the collections of these gardens. The tuber of Amorphophallus Titanum flowered at Kew many years ago was raised at Sesto from seeds sent by Dr. Beccari from Sumatra and sown by myself."

Mr. F. Howard, of Los Angeles, California (quoted by Mr. J. Coutts in Gardeners' Chronicle, Nov. 21, 1925), states:

"Among the various novelties resulting from our work in the cross-breeding of plants, we consider this as being easily the most remarkable of our productions. It is a true bi-generic hybrid, of which there are but comparatively few in existence. It is a true cross of Crinum Moorei on Amaryllis Belladonna, the latter being the seed-bearing parent. The value of this new plant lies in its usefulness as a bulbous plant for growing in pots or for planting in the open garden. Its beautiful soft pink color, the immense trusses of bloom which it bears, combined with the lasting character of its flowers, place it in a class by itself. Stems four feet long, with immense heads of bloom, suitable for vases, etc., are freely produced throughout the summer and autumn months. The tone of soft pink to be noted in its flowers is one that is rarely seen and will appeal to everyone."

Mr. A. Worsley, in "Gardeners' Chronicle," February 11, 1928, discusses some important differences between the plants raised by each hybridist, and suggests the possibility of the *Crinum Moorei* used by Mr. Howard having been one of the many horticultural forms instead of the true type. This might account for the difference in the two. The Howard plant has a decidedly short tube about one inch long, whereas the plants from Dr. Ragionieri are more robust and of a more rapid growth, have a tube five and a half inches long, and

segments almost twice as wide. Again, the Italian plant is evergreen, whereas in England the California plant is partly deciduous or liable to be cut down by the frost. The leaves, however, are persistent to the extent of pushing up into new growth immediately.

The California plant is beginning to find its way into the American catalogues under its American name, *Amarcrinum Howardii*. However, Dr. Otto Stapf, who described it in the "Botanical Magazine," plate 9162, from a plant flowered at Kew, sent from Mr. Howard's garden, recognizes the priority of Dr. Ragionieri's name, *Crin[o]donna Corsii*.

This free-flowering bulbous hybrid is a welcome addition to our gardens. However, its hardiness is questionable in St. Louis, and the bulbs should not be attempted out of doors unless duplicate bulbs are available. Its popularity as a window plant is growing, especially as a companion to *Hippeastrum Johnsonii,* frequently seen in bloom in window gardens. Flowers of the latter are repeatedly brought to the Garden for identification in the spring as something new and rare. On the contrary, it is the oldest hybrid in the genus, having been raised by an English watchmaker in 1799, from *H. Reginae* crossed with *H. vittatum.*

The bulbs of *Crinodonna Corsii* were deciduous when received by the Garden in the winter. They were immediately planted in a sandy sod soil in six-inch pots and placed in the cool house where a minimum temperature of 60° F. is maintained. The bulbs commenced to grow in the spring, and as soon as weather permitted they were planted outside. The plant suggested a dwarf *Crinum Moorei* by its wide laterally grooved and recurved leaves, supported by an elongated collar. During early September a flower spike appeared, at which time the plant was removed to the greenhouse. The first flower opened on October 3 (plate 6). Its beautiful delicate pink color, shape, and fragrance was distinctly like the Belladonna lily, but the difference lay in the narrow and curved tube and slight curvature of the limb. In general the hybrid might be regarded as having the growth of *Crinum Moorei* and the flowers of *Amaryllis Belladonna.*

G. H. P.

NEW OR NOTEWORTHY PLANTS FOR ST. LOUIS. II.

TITHONIA SPECIOSA (SHOWY MEXICAN SUNFLOWER)

Last summer this brilliant-flowered Mexican annual, advertised in American and English seed catalogues as the "Flower of the Incas," was grown at the Garden and in several gardens around St. Louis. During the St. Louis Horticultural Society flower show held in the floral display house last fall, a vase of the orange-red cut flowers was displayed by Mr. John W. Cook of Webster Groves, who had grown some giant specimens. The exhibit attracted many gardeners and flower lovers, despite the fact that it was surrounded by the varied-colored dahlias, and it was awarded the Society's special award as an outstanding annual. As a cut flower it is quite noteworthy for its lasting quality. The accompanying photograph (pl. 7, fig. 1) was taken the day after the closing of the exhibition, four days after the flowers were cut from the plant.

Tithonia is a very small genus of tropical annuals. The generic name is derived from the mythological Tithonus, a favorite of Aurora, and the specific name means "showy." The plant was first described by William Jackson Hooker in the "Botanical Magazine" in 1834, plate 3295, as *Helianthus speciosus.* Seeds were collected in the vicinity of Jorullo, Mexico, in 1832, by Mr. W. Higson and later sent to his friend, Mr. Edwards Leeds, of Manchester, England. One plant was successfully raised and a single flower opened before frost. This was subsequently sent to Mr. Hooker for identification, who noted that the flower was very fragmentary upon arrival. He further states: "I confess I have had some difficulty in referring this plant to its proper genus: the swollen peduncle, orange-coloured flowers, and lobed leaves, would lead me to consider it a Tithonia; perhaps even *T. tagetiflora;* but the involucre and pappus, and scales of the receptacle are very different, unless the figure strangely misrepresents these parts, and in all essential characters it agrees well with the third subgenus of Helianthus of Lessing."

This interesting plant seemed to have escaped cultivation for at least eighty years, when it again appeared in England

TITHONIA SPECIOSA EXHIBITED AT THE ST. LOUIS HORTICULTURAL SOCIETY FLOWER SHOW

(Courtesy of Mr. A.W. Dreyer)

PLANTS OF TITHONIA SPECIOSA GROWN BY MR. JOHN W. COOK OF WEBSTER GROVES, MO.

(Courtesy of Mr. John W. Cook)

SEEDLINGS OF SUCCULENTS

TITANOPSIS SCHWANTESI (TOP) AND T. CALCAREA (BOTTOM)

in 1915. At this time its brilliant flowers were shown before the Royal Horticultural Society, resulting in an award of merit being given to the grower, Mr. W. Bachetor. It attracted no little attention, since at that time hybridists were attempting to obtain a large red sunflower, and the color of the Mexican plant made such a creation seem a possibility. In view of its gigantic growth and lateness in flowering it is not a desirable annual for small gardens, unless special attention is given to proper staking. Its flowering period may be hastened by sowing the seeds early in the greenhouse and growing on in pots, planting out the established plants in early May in full sunshine. Mr. Cook demonstrates the necessity of using a step-ladder to view the flowers, since the plant often reaches twelve to fifteen feet in height (pl. 7, fig. 2).

G. H. P.

GROWING SUCCULENTS FROM SEED IN THE HOME

Lovers of the bizarre and fantastic in plant life will find a fascinating subject in growing cacti and other succulents from seed. A greenhouse is not necessary, and any one can grow such plants in the home provided a few set rules are followed.

First of all, remember that seeds of succulents, no matter what kind, must never be planted deeper than the length of the seed itself. A mixture of garden loam, leaf mold, and sand in equal parts is the best medium for growing them. Fill the pot, pan, or any suitable container about one-fourth full of broken pottery for drainage. Then sift the soil into the pot to within one-half inch of the rim. Press the soil down so it will not be too loose, and distribute the seeds evenly on the surface. Then set the pot in water until the surface of the soil is damp. This will draw the seeds down. Now sift just enough soil over the seeds to cover. It is also advisable to sift very fine gravel on top, as it helps to support the germinated plants and it likewise retains the moisture. Finally, put a glass cover over the pot to insure even temperature, and place in the light.

Keep the soil moist, but not wet, by immersing the container in water rather than by syringing or sprinkling from

above, as the latter method is apt to wash out the seeds. Insert a small stick under one side of the glass occasionally, so that mold and other fungi will not form on the soil or sides of the pot.

Some seeds germinate within three days to a week under good conditions or, in other words, after the first watering. Old seeds may take six months or more for germination, so be patient. After they have germinated remove the glass cover, but do not place the seedlings under the direct rays of the sun, as this will cause them to burn. If necessary shade with paper, cloth, or a painted glass. When seedlings are two to three weeks old and are crowded in the pot, it is safe for them to be transplanted, replanting a trifle deeper. Be careful not to break the very fine, usually single, hair-like root. It is advisable for a few months to water from below by immersion, as stated previously. By immersion is not meant that the water be allowed to accumulate until it runs over the top. In winter, especially, water sparingly, as too much moisture will cause the seedlings to damp-off.

Seeds of succulents can be procured at a nominal price from various cactus dealers in this country and abroad. Seeds of "Old Man Cactus" germinate readily, and the seedlings are quite a curiosity even in their early stages. Other cactus seeds germinate just as readily, and at present the markets are flooded with seeds of those marvelous stonefaces, mimic plants of the African Mesembryanthema, easy of culture and well worth one's while.

LAD CUTAK.

PLANTS THAT PRODUCE LIGHT

That some plants can produce light is not generally known. While it is true that reports on light production in plants date back to early times, they are generally believed to have their origin in superstition or the imagination of the observer.

The daughter of the famous botanist, Linnaeus, observed light radiating from nasturtium flowers during a warm and dry summer night and recorded it for the first time. This phenomenon has been repeatedly observed, and it can be artificially reproduced in the laboratory. If a nasturtium

CONOPHYTUM LUISAE AND C. VANRHYNDORPENSE

RIMARIA HEATHII

HERERO GRANULATA

CHEIRIDOPSIS PECULIARIS AND RIMARIA HEATHII

plant is insulated from the earth and connected with one electrode of an electrical machine, light may be observed radiating from the blossoms in a darkened room, provided the air is quite dry. In this case the plant serves as a conductor for the electricity, and the petals with their hairs and finely fringed edges give rise to the same phenomenon frequently observed on mast-heads at sea and which is called "St. Elmo's fire" or "corpse light." Travelers, looking down into crevices in rocks or caves, have been surprised to see light coming from deeper points or spots of the small cavities. An investigation of the cause will reveal the growth of a small moss which covers the background of the crevices just opposite to the incident light. This very tiny moss is composed of spherical cells containing half-moon-shaped green color-bodies. The transparent cell walls of the small spherical cells serve as a lens, directing the collected rays to the color-body. When seen at a certain angle the eye will perceive the light rays reflected from the color-body, and the impression is that of light emitted by the plant. That the light is not produced by the plant itself but is only reflected, can be proved when investigating the same moss growth at night without any light source. Because of this interesting property, this particular moss is called "luminous moss" *(Schistostega osmundacea)*.

Again, when a body of water is covered with a coherent scum, it may appear, especially in the bright sunlight, to be covered with a very delicate layer of gold dust. This is due to the presence of a tiny water plant belonging to the unicellular algae *(Chromophyton Rosanoffii)*. This single-celled organism is constructed in the same way as the cells of the luminous moss. But in this case, the chlorophyll-body has a yellowish-green color, and when the reflected light rays are viewed from a certain angle the tiny plant appears golden.

Those who have taken an ocean trip will remember the magnificent sight displayed in the waves on a dark night. Although most of this display comes from minute animals, a certain part is due to the presence of bacteria and, as far as the latter are concerned, the light produced is dependent

upon the quantity of oxygen brought into the sea-water by the stirring action of the boat.

The often-observed light on meat or fish is also due to the presence of bacteria. Careful investigation will show that the light is produced only on the surface where air has access to the organisms. Walking through woods or forests at night in the summer or fall, there may be noticed spots of light here and there in the decaying wood or wet oak or beech leaves. It is a greenish-white or greenish-blue light, steady and not sparkling, emitted continuously and not changing in color or intensity. In most cases this is due to the presence of a wood-destroying fungus. In the eastern part of the United States a fungus is found growing on dying trunks and stumps of deciduous trees, forming large orange-colored clusters. This is one of the most important luminescent fungi and is popularly known as "Jack-my-lantern" *(Monadelphus illudens)*.

Thus the light seen on the nasturtium flowers, in the moss, and in the small water plant is quite different from the actual light produced by bacteria and fungi. Naturally this latter phenomenon attracted the attention of scientists and, as early as 1843, J. F. Heller reported on an investigation made on decaying woods. He expressed the opinion that here the light is not produced by the wood itself but by growth of a fungus. Later Heller investigated the luminescence of meat and other organic material and pointed out that the production of light was not due to the decay of the material itself but to the presence of a fungus which grew on the surface of the decomposing material. Many years later when the methods for cultivating and identifying microscopical organisms had been improved, scientists were able to study these organisms and their light-producing properties, so that more than 25 different species of light-producing bacteria are known and described, most of them cultivated from sea water. It has been found that, beside oxygen, certain salts play an important part in this process; especially common salt, together with the salts of chlorine, potassium, magnesium, and calcium. When light-producing bacteria are grown on artificial nutrient media which contain sufficient quantities of these salts, the culture produces light for a

long time. Gradually, however, with the consumption of these salts, the intensity decreases and finally ceases entirely. But if granules of these salts are dropped on the surface of the culture, the areas surrounding the salt granules will start to produce light after a relatively short time, often in a few seconds. This reaction is very sensitive and can be compared only with Bunsen's flame reaction, which is used for the detection of the minutest quantities of certain elements.

Although bacterial light in itself is relatively weak, it is nevertheless strong enough to act upon a photographic plate, and it is possible to take a picture of a light-producing bacterial growth if the photographic plate is exposed for several hours. Even pictures of objects which are illuminated only by bacterial light may be taken if the plate is exposed for a sufficiently long time. It has been suggested that this "cold light" could be used in places where inflammable substances are handled or where danger of explosions from flames is frequent. But the practical handling of such "bacterial lamps" has never been satisfactorily perfected.

Originally it was assumed that organic compounds are broken down in the bacterial cell, giving rise to free phosphorus, which "in a free state" produces light. Many organic compounds produce light when in contact with oxygen under certain conditions. Since the quality of the light produced by these organic compounds and that produced by the living organism was similar, the explanation seemed to be the same for both. But from our present knowledge there is no evidence of active oxygen in the uninjured cell. On the other hand, a French investigator has succeeded in separating two liquids from luminous animals, neither of which produce light but when mixed in a certain ratio result in a light-producing liquid. These two chemical bodies contained in the solutions have been called "Luciferin" and "Luciferase." Luciferin is supposed to be present everywhere in light-producing animals and plants, whereas luciferase is present only at those places where light is being produced. It seems, therefore, that luciferase would have a function similar to that of an enzyme or ferment. If luciferase is brought into contact with luciferin in the presence of water and oxygen, light is produced. While the method

by which bacteria and fungi give off light is not fully explained, the general conception is that the cells of these plants contain luciferin, which, in the presence of oxygen and water, is easily oxidized. The energy gained by this process is radiated as light.

R. V. L.

NOTES

Mr. G. H. Pring, Superintendent of the Garden, has been re-elected president of the St. Louis Horticultural Society.

Mr. Aaron Kipnes, graduate student from the University of Iowa, Iowa City, visited the library and herbarium, January 28.

Mrs. Katherine H. Leigh, assistant to the director, spoke before the Webster Groves Home Garden Club, January 9, on "The Making of Bubble Bouquets."

Dr. C. W. Dodge, Mycologist to the Garden, gave a talk at the Pilgrim Congregational Church, February 22, on "Recent Literary and Artistic Trends in Costa Rica."

Mr. L. P. Jensen, Manager of the Missouri Botanical Garden Arboretum, spoke before the Greater St. Louis Association of Gardeners at the Kirkwood High School, January 7, on "How to Plant the Home Grounds"; and before the students of the Washington, Mo. High School, January 21, on "Conservation of Native Plants."

Mr. L. P. Jensen is the author of an article in "Parks and Recreation (Vol. XVI, No. 5) on "Identification of Woody Plants in Winter"; and of one in the "Missouri Magazine" (January, 1933), entitled "A Plea for Missouri Bird Life." The latter article was reprinted in the February 3 issue of the "Washington, Mo. Citizen."

Dr. George T. Moore, Director of the Garden, spoke at the Delmar Baptist Church, January 24, on "Henry Shaw and His Garden"; at the tenth annual Florists' Week meeting of the Illinois State Florists' Association, University of Illinois, Urbana, January 31, on "Plant Life," illustrated with moving pictures; February 8, before the St. Louis Colloid Medical Club, at the Forest Park Hotel, on "The Plant Commonwealth"; February 17, before the Civitan Club, at the Hotel Statler, "The National Flower Show."

Mr. G. H. Pring, Superintendent of the Garden, has given the following talks recently: the afternoon of January 28, before the Webster Groves Home Garden Club, "The National Flower Show"; the evening of January 28, before the St. Louis League for the Hard of Hearing, "What to Plant in City Gardens"; February 2, at the tenth annual Florists' Week, meeting of the Illinois State Florists' Association, University of Illinois, Urbana, "Water Lilies and Water Gardens"; February 17, before the Gavel Club of St. Louis and St. Louis County, "How to Take Advantage of Arbor Day."

STATISTICAL INFORMATION FOR JANUARY, 1933

GARDEN ATTENDANCE:

Total number of visitors.....29,062

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought.....	64
Total number of books and pamphlets donated.....	112

PLANT ACCESSIONS:

Total number of plants and seed packets donated.....	95

HERBARIUM ACCESSIONS:

By Purchase—

Field Museum of Natural History — Photographs of *Grindelia* types.....	5
Jones, Professor Marcus E.—Plants of Mexico.....	437
Samuelsson, Dr. G. — Plants of Argentina collected by E. L. Ekmann.....	252
Schipp, William A.—Plants of British Honduras.....	60
Verdoorn, Fr.—"Hepaticae, Selectae et Criticae" Ser. V, Nos. 201-300, inclusive.....	100

By Gift—

Kellogg, John H. — *Rubus missouricus* Bailey from Missouri	10
Pring, G. H.—Plants of horticulture.....	3

By Exchange—

University of California—Willows of Alaska, California, etc.	165
University of Michigan — Mosses of British Honduras and Guatemala, collected by H. H. Bartlett.....	29
Total	1,061

SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date to the death of Mr. Shaw, in 1889, the Garden was maintained under the personal direction of its founder, and, while virtually a private garden, it was, except at certain stated times, always open to the public. Although popularly known as "Shaw's Garden" the name Missouri Botanical Garden was designated by Mr. Shaw as its official title and in his will or in any of his writings he specifically referred to it as the "Missouri Botanical Garden." By a provision of Mr. Shaw's will the Garden passed at his death into the hands of a Board of Trustees. The original members of the Board were designated in the will, and the Board so constituted, exclusive of certain ex-officio members, is self-perpetuating. By a further provision of the will, the immediate direction of the Garden is vested in a Director, appointed by the Board of Trustees. The Garden receives no income from city or state, but is supported entirely from funds left by the founder.

The city Garden comprises 75 acres, where about 12,000 species of plants are growing. There is now in process of development a tract of land of over 1,500 acres outside the city limits which is to be devoted to (1) the propagation and growing of plants, trees, and shrubs, designed for showing either indoors or outside, at the city Garden, thus avoiding the existing difficulties of growing plants in the city atmosphere; (2) gradually establishing an arboretum as well as holding a certain area as a forest reservation, with the idea that possibly at some future time this may become the new botanical garden.

The Garden is open to the public every day in the year, except New Year's Day and Christmas—week days from 8:00 a. m. until one-half hour after sunset; Sundays from 10 a. m. until sunset.

The main entrance to the Garden is located at Tower Grove Avenue and Flora Place, on the Sarah car line (No. 42). Transfer south from all intersecting lines. The Garden may also be reached by Bus Route No. 12, to which all other motor-bus lines transfer.

STAFF
OF THE MISSOURI BOTANICAL GARDEN

GEORGE T. MOORE,
Director

KATHERINE H. LEIGH,
Assistant to the Director

HERMANN VON SCHRENK,
Pathologist

CARROLL W. DODGE,
Mycologist

JESSE M. GREENMAN,
Curator of Herbarium

ROLAND V. LAGARDE,
Research Assistant

ERNEST S. REYNOLDS,
Physiologist

ROBERT E. WOODSON, JR.,
Research Assistant

NELL C. HORNER,
Librarian and Editor of Publications

GEORGE H. PRING,
Superintendent

JOHN NOYES,
Consulting Landscape Architect

PAUL A. KOHL,
Floriculturist

W. F. LANGAN,
Chief Engineer

A. P. BEILMANN,
Arboriculturist

J. H. KELLOGG,
Plant Collector

J. CUTAK,
In charge Exotics

J. LANGAN,
Assistant Engineer

A. D. FORRESTER,
Plant Recorder

A. PEARSON,
Painter

ARBORETUM

L. P. JENSEN,
Manager

G. GOEDEKE,
Foreman

D. MILLER,
Orchid Grower

R. E. KISSECK,
Engineer

TROPICAL STATION, BALBOA, CANAL ZONE

A. A. HUNTER,
Manager

REPRESENTATIVE IN EUROPE

GURNEY WILSON, F. L. S.

MISSOURI BOTANICAL GARDEN BULLETIN

Vol. XXI MARCH, 1933 No. 3

CONTENTS

	Page
Water-lilies	49
"Vegetation-Pictures from North America"	55
Notes	57
Statistical Information	59

ST. LOUIS, MO.
1933

Published Monthly, Except July and August, by the Board of Trustees

SUBSCRIPTION PRICE:

ONE DOLLAR PER YEAR SINGLE COPIES TEN CENTS

BOARD OF TRUSTEES
OF THE MISSOURI BOTANICAL GARDEN

THE ORIGINAL MEMBERS WERE DESIGNATED IN MR. SHAW'S WILL AND THE BOARD SO CONSTITUTED, EXCLUSIVE OF THE *EX-OFFICIO* MEMBERS, IS SELF-PERPETUATING

President
GEORGE C. HITCHCOCK

Vice-President
SAMUEL C. DAVIS

Second Vice-President
DANIEL K. CATLIN

L. RAY CARTER

ALBERT T. PERKINS

THOMAS S. MAFFITT

EUGENE PETTUS

GEORGE T. MOORE

ETHAN A. H. SHEPLEY

FRED G. ZEIBIG

EX-OFFICIO MEMBERS

GEORGE R. THROOP,
Chancellor of Washington University

VICTOR J. MILLER,
Mayor of the City of St. Louis

FREDERICK F. JOHNSON,
Bishop of the Diocese of Missouri

JOHN J. LICHTER,
President of The Academy of Science of St. Louis

MYRT A. ROLLINS
President of the Board of Education of St. Louis

Secretary
GEORGE F. HEFFERNAN

NYMPHAEA KEWENSIS, KEPT DORMANT IN SAND FOR FOUR YEARS, SHOWING SLIGHT SHRIVELLING.

SAME TUBERS AFTER BEING KEPT IN THE PROPAGATING TANK FOR THREE WEEKS, SHOWING ROOTED SHOOTS (ON THE LEFT) READY TO BE SEGREGATED FROM TUBER.

Missouri Botanical Garden Bulletin

Vol. XXI MARCH, 1933 No. 3

WATER-LILIES

The cultivation of the water-lily dates back to the time of the Egyptian Pharaohs. The plant was valued both for its beauty and its economic importance, and even now the tubers and seeds are used for food in some countries. In Egypt the water-lily had a religious significance also. Two species, *Nymphaea Lotus,* the white night-blooming lily (the sacred lotus of the Nile), and *N. caerulea,* the blue day-blooming lily, are pictured on the Egyptian monuments or tombstones. The use of flowers for funeral wreaths was common during the nineteenth and twenty-first dynasties, and it was the custom to lay wreaths or half-wreaths of flowers on the breast of the wrapped corpse. The German botanist, Schweinfurth, found petals and sepals of *N. caerulea* and *N. Lotus* in the funeral wreaths of Rameses II (1590 B. C.). The water-lily of China is *Nymphaea tetragona,* the pygmy of the genus, and was mentioned in Chinese literature as having been cultivated as far back as the T'ang Dynasty (618 A. D.).

The aristocrats of the water-lilies are the tropical varieties, with their large fragrant blossoms rising a foot or more above the water. They naturally fall in two groups, day-blooming and night-blooming. The opening and closing of the flowers is governed by sunlight and temperature, and the modern use of flood lights for night display has no effect on the flowers. In July and August, when the temperature is about 70° F. they will open and close with startling regularity—the night bloomers staying open from 7 p. m.

until 9 a. m., and the day-bloomers opening at 8 a. m. and going to sleep at 6 p. m. When the temperature is below 70° F. and there is no sunlight the day-bloomers often stay asleep throughout the day, and the night-bloomers become very much awake.

Breeding new water-lilies is a comparatively recent accomplishment. The first hybrid water-lily was *Nymphaea devoniensis,* created in 1851 by Paxton, gardener to the Duke of Devonshire. During 1888-90 the French hybridist, M. Latour Marliac, won the appreciation of all lily growers by his introduction of the yellow and pink hardy water-lilies. Through the achievements of Mr. James Gurney, formerly head gardener of the Missouri Botanical Garden, St. Louis first became recognized far and wide for its introduction of new tropical water-lilies, the climate being admirably adapted for growing them. Since 1912 work on the breeding of day-blooming varieties has been carried on at the Garden. An outstanding hybrid produced here is the pure white variety "Mrs. G. H. Pring," the first white tropical day-bloomer to be introduced.

Of unusual interest, not only to this country but to the entire world, was the discovery in Africa in 1930 of a yellow lily. At first it was supposed to be *Nymphaea Stuhlmannii,* but later it proved to be a new species and was named *Nymphaea Burttii* in honor of its collector, Mr. B. D. Burtt, of the Department of Tsetse Research, Tanganyika, Africa. The discovery of this lily was not merely a horticultural triumph, but its new color provided material for a number of breeding experiments. The outstanding hybrid so far is the light yellow tropical lily which has been named "St. Louis." However, since it is necessary to propagate tubers in large quantity before they can be distributed, this will not be available commercially for at least two years.

The first consideration for growing lilies is the construction of a pool. A natural pool may be easily constructed by digging it in a low place in the garden exposed to full sunshine, or a concrete basin may be built. The size of the pool should be governed by the plan of the garden. A pool six or eight feet in diameter will accommodate a maximum of three large lilies, and overcrowding spoils the effect of the

water garden. In any case there should be at least a foot of water above the planting level, while a foot and a half is better for hardy lilies in order to prevent possible freezing in winter. If the pool must be drained in winter, the roots of the hardy lilies should be covered with a thick layer of straw or manure, or if they have been planted in boxes the plants should be removed to a cool cellar.

Water-lilies, especially the tropical varieties, are rank feeders, and a liberal supply of fertilizer is essential. Where the subsoil will permit making of natural ponds, the soil should be well fertilized with cow manure before planting. When concrete ponds have been built, two inches of the manure should be spread over the bottom, and ordinary sod soil added to a depth of eight inches. An objection is that the water becomes discolored and may remain so if agitated by the movement of fish in the pool. Planting the lilies in boxes two to three feet square and a foot deep and placing them on the bottom of the pool is the simplest method of culture for the amateur. Frequently half-barrels are used.

The hardy lilies need less attention than the tropical ones. Their growth is from continuous thickened roots or rhizomes which subdivide, and for this reason the plants must be confined to a restricted area and transplanted every four years. When grown in small boxes, fresh soil should be added at the time of removal. The rhizomes should be planted in early spring about two to three inches deep, the growing portion being level with the top of the soil.

The tropical lilies are more fascinating to grow, especially when a pool is planted with both night- and day-bloomers. Unless heated tanks in a greenhouse are available during the winter, the tropical varieties should be treated by the amateur as annuals. Their magnificent blooms during the summer will more than justify the moderate cost of replacing them each year. The time of planting depends upon the locality. It must be remembered that the purchased plants have been wintered in water at a minimum temperature of 70° F. and are susceptible to chilling in cooler water, resulting in their "going to sleep" or becoming dormant. In St. Louis the lilies should not be planted until after May 15, when the temperature of the water should be at least 70° F. The plants should

be set with the crown just below the surface of the soil. As the lilies grow the water should be raised until it is a foot above the roots. By July 1 the plants start to flower with remarkable regularity, and continue until killed back by frost, usually in October.

PROPAGATION

There are three methods by which the grower may increase his plants: (1) by seed, (2) by leaf propagation (viviparous types only), and (3) by tubers.

1. *Seeds.*—Seeds should be used only in creating new forms, or perpetuating the species. Seeds of hybrids pollinated by insects rarely will produce flowers true to type. True species, such as *N. caerulea, N. ovalifolia, N. Burttii,* will come true to type, provided the flower is emasculated in the bud stage and both parent flowers protected from insect pollination. For the best results the time of crossing is limited to the first day of the flower's opening, between 10 a. m. and noon, at which time the pistil is filled with nectar. After the first day the concave pistil is dry, being covered by the stamens.

After pollination the flower should be covered with thin muslin and tied to a stake, the string being left long enough to permit the natural lowering of the flower under the water for seed development. The pod will ripen in about three weeks, when it will again rise to the surface of the water, and unless it has been wrapped with muslin, the natural dehiscence will have broadcast the seeds over the surface of the pond. Further ripening is necessary to disintegrate the fleshy covering, this being accomplished by placing the seed in a battery jar of water for three or four days. Virile seeds, when ripened fully, sink to the bottom of the container. In order to prevent premature germination, they should be removed from the water and dried for two or three days. When the seeds separate readily, they may be immediately sown in sandy soil in shallow pans, or, more conveniently, in ordinary glass battery jars which are half filled with soil. The seeds should be broadcast evenly, barely covered with finely sieved sand, and the soil firmed gently to prevent seed

from floating while jar is being filled with water. The jars may then be placed in the heated tanks at a temperature of 75-80° F. As soon as the seedlings develop floating leaves they may be transplanted into small pots for further development.

2. *Leaf propagation*.—This method is restricted to such viviparous hybrids as *N.* "Mrs. Woodrow Wilson" *gigantea*, *N.* "Panama Pacific", *N. Daubeniana*, and *N.* "August Koch", all of *N. micrantha* parentage. The young plants are produced from the leaf sinus, and since they produce roots they are simply cut from the parent leaf and potted. Propagation is carried on from July until frost, when sufficient stock for the following summer may be established. If given room for good root growth, these will bloom during the winter.

3. *Tuber propagation*.—The non-viviparous lilies are increased by tubers only. The old tubers developed outside are of practically no use for propagation. In fact, it is a waste of labor to dig up the plants in the fall and transfer them to the greenhouse. When the young pot plants are planted in the outside ponds they possess a small tuber resembling a hickory nut (see pl. 10, fig. 1). During the summer the tuber grows until it attains the size of a medium-sized potato, and young tubers form at the base of the parent tuber. The latter furnish the propagating stock and may be removed from the plant at the end of August or early in September.

It is best to give the bulbs a partial resting period before planting by placing them in sand for two or three weeks. Experience will teach the grower to store them in a tin container with top, since both rats and mice relish them as a delicacy. After the resting period, the tubers should be potted in sandy soil, being planted deep to induce a long radical growth, and kept at a temperature of 80° F. The young leaves will appear within two weeks (see pl. 10, fig. 2). As soon as two floating leaves develop, dig into the soil with thumb and finger to locate the radical or stem at the top of the tuber. Then pinch off the young plant with roots attached, just above the tuber, and pot immediately before it has had time to dry out. A good propagating tuber should

yield at least twelve young plants before going to sleep. Best results are obtained with the pot-grown tubers, disregarding the outside plants. This applies to both the night- and day-bloomers of the tropical lilies. The domestic lilies, which possess a creeping rhizome, are easily propagated by division.

Unless one is acquainted with the many up-to-date hybrids it is far better to be guided by the catalogues of the water-lily specialists in which are published various collections designed to show variety of color and price. Those wishing to experiment with the pygmy hardy lilies which are suitable for tub culture should select:

Nymphaea tetragona, white
Nymphaea tetragona helvola, yellow
Nymphaea Laydekeri fulgens, reddish

The following standard hardy lilies selected from the inexpensive varieties will prove satisfactory:

Nymphaea "James Brydon" ..... amaranth-purple
Nymphaea "Gladstone" ..... white
Nymphaea Marliacea chromatella .... pale green-yellow
Nymphaea "Eugene de Land" ..... rose-pink
Nymphaea "Attraction" ..... viridine-yellow, flushed with light rosalene purple.

Following is a list of tropical lilies *de luxe*, both night- and day-blooming varieties, which lend fragrance and color to the garden at all hours:

Night-blooming varieties—
Nymphaea "Frank Trelease" ..... Tyrian pink
Nymphaea Lotus gigantea ..... white
Nymphaea "Mrs. George C. Hitchcock" ..... rose-pink
Nymphaea "C. E. Hutchings" ..... Tyrian rose
Nymphaea "H. C. Haarstick" ..... rose

Day-blooming varieties—
Nymphaea "Mrs. Edwards Whitaker" .. pale campanula-blue
Nymphaea "General Pershing" ..... pale rose-purple
Nymphaea "Mrs. G. H. Pring" ..... pure white
Nymphaea "Henry Shaw" ..... light campanula-blue
Nymphaea "Panama Pacific" ..... lavender-violet
Nymphaea "St. Louis" ..... primrose-yellow

For good-flowering water-lilies in the Middle West the St. Louis raised hybrids are naturally the best. In any case, a personal visit to the Missouri Botanical Garden will prove of great interest and profit to every lover of color and beauty of form during water-lily time.

G. H. P.

"VEGETATION-PICTURES FROM NORTH AMERICA"

Under the above title there appeared in the April 1, 1904, number of Möller's "Deutsche Gärtner-Zeitung" a burlesque account of the remarkable fertility of the soil about St. Louis. While this garden magazine is ordinarily devoted to the most serious discussion of horticultural subjects, this entire number is written in the spirit of April Fool. Of particular interest to those who recall St. Louis at the time of the World's Fair are the pictures and a translation of a part of the text, reproduced herewith.

"North America still remains a country of unexhausted marvels, not only because of its primeval forests but also because of its cultivated vegetation.

"Some time ago a German, who intends to arrange community trips to the World-Fair which is going to be held this summer in St. Louis, was investigating the little-explored surroundings of the Fair City in order to find surprises of a special kind for his party and had such a surprise himself.

"As the train reached the valley of a tributary of the Mississippi, until then overgrown and therefore unknown, in the primeval forests (which recently had been connected by a railroad with the U. S. Railways) it was derailed in the night for a peculiar reason.

"The ground had been loosened and cleared as though the primeval forests had been blown up with dynamite; in this virgin soil, which naturally was very fertile, the signalman had planted in the morning of the preceding day cucumber-seeds, and within a few hours they had not only germinated but had developed in such an astonishing way that they had formed fruits by evening. During the early part of the night the fruits, some of which had grown over the tracks, had reached such a size and consistency that the train was derailed by their resistance.

"Our special photographer, who is always present on occasions like this, was lucky enough to make a snapshot which turned out to be very successful.

"Continuing his trip, he had an opportunity to admire the incomprehensible fertility of the former virgin soil which

had been utilized for agricultural purposes. In the vicinity of a wheat field for some reason cowboys had started a fight; since the revolvers and revolver bullets were without effect on the hard skulls, they beat their hard heads with the wheat ears until they were bleeding. It was an interesting sight to see the wheat grains flying around like bullets and many a fighter stretched on the ground.

"A picture of surprising primeval forest vegetation was offered when the cultivated area had been left behind and the river was reached. Here a new liana was discovered, a kind of bean *Phaseolus gigas*, which produces pods of such dimensions and consistency that the inhabitants of the primeval forests use them as boats. The rope-like stems, on which the pods are suspended, are used as ropes for tieing the boats.

"The explorations of the vicinity of the Fair-City are continued, and further surprises are to be expected.

"*The Rhubarb House at the World's Fair in St. Louis.*— The greatest and in another respect most important object of interest for the German visitors at the World's Fair in St. Louis, which is going to be held this year, will be the Rhubarb House; it was built by a speculative Yankee from the stems of the "Improved American Giant-Rhubarb," which in North America develops to an enormous size. The builder counted especially on German visitors. It will be surrounded by a Rhubarb Park, which will demonstrate how luxuriantly in North America the Rhubarb and other things too run into foliage.

"The most important thing about the whole undertaking of this Rhubarb House was the concession for the retailing of "Rhubarb Wine"; this was done so as not to lose the favor of the temperance party, which has a great and powerful influence in the State of Missouri.

"Recently, when the business was dedicated to its purpose, all guests were very pleased to find out what was hidden under the pretense of "Rhubarb Wine."

"We call the attention of the German visitors of the World's Fair to this Rhubarb House, because we are convinced that they will find out that they will get, under the names Rüdesheimer, Johannisberger, Hochheimer, Mark-

"DERAILMENT OF TRAIN BY CUCUMBERS"

(From Möller's Deutsche Gärtner-Zeitung, April 1, 1904)

"FIGHT IN A WHEAT FIELD NEAR ST. LOUIS"

(From Möller's Deutsche Gärtner-Zeitung, April 1, 1904)

"THE CANOE LIANA IN THE WILDS NEAR ST. LOUIS"

(From Möller's Deutsche Gärtner-Zeitung, April 1, 1904)

"RHUBARB HOUSE AT THE WORLD'S FAIR IN ST. LOUIS."

(From Möller's Deutsche Gärtner-Zeitung, April 1, 1904)

gräfler, Bernkasteler, Scharzberger, etc., Rhubarb Wine; pretty soon they will find out how agreeably these Rhubarb Wines stimulate the disposition.

"It would be recommended that this "Improved American Giant-Rhubarb" be introduced into our country. Although it is not necessary to cover our native tipplings with rhubarb leaves, the giant species of rhubarb would make a very decorative plant in our gardens."

NOTES

Mr. Paul D. Keeler, Director of the Wisconsin Conservation Department, Madison, Wis., visited the Garden and Arboretum recently.

Miss Esther Adams, instructor in biological science, Moberly Junior College, Moberly, Mo., accompanied by her class in botany, visited the library and herbarium, February 19.

Mr. L. P. Jensen, Manager Missouri Botanical Garden Arboretum, gave an illustrated talk before the Gray Summit Garden Club, March 6, on "The History of Landscape Gardening."

Dr. Hermann von Schrenk, Pathologist to the Garden, visited Mexico recently. While at Santa Maria del Tule he measured the giant Humboldt cypress tree ("The Oldest Living Tree," December, 1916, number of the BULLETIN), and at Cuernavaca he visited Mr. Erik Östlund and his orchid collection.

Dr. George T. Moore, Director of the Garden, gave a talk on "Some Little-known Plant Activities," illustrated with moving pictures, after the banquet of the North-Central States Entomologists' Conference, at the Hotel Statler, March 2. On March 20, he spoke at St. Stephen's House on "Henry Shaw and His Garden"; and on March 28, during the National Flower Show, he presented moving pictures of "Plant Life" before the Society of American Florists, at the Hotel Chase.

Mr. George H. Pring, Superintendent of the Garden, has given the following talks recently: February 22, before the O'Fallon Woman's Club, O'Fallon, Mo., "What to Plant in

Your Garden"; February 27, at a meeting of the Florists' Telegraph Delivery Association, at the Congress Hotel, "Controlling Flowering Plants for the National Flower Show"; February 28, before the X Club, "Arbor Day and the National Flower Show"; the afternoon of March 13, before the 20th Century Club, at the Jefferson Memorial, and in the evening, before the St. Clair Garden Club, East St. Louis, "The National Flower Show"; March 7, before the senior students of Cleveland High School, "The Advantages of Floriculture as a Profession"; March 14, before the Carondelet Improvement Association, Carondelet Branch Library, "St. Louis Gardens"; March 19, radio talk over Station KSD, "Changing Winter Into Summer at the National Flower and Garden Show."

STATISTICAL INFORMATION FOR FEBRUARY, 1933

GARDEN ATTENDANCE:

Total number of visitors	14,956

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought	137
Total number of books and pamphlets donated	62

PLANT ACCESSIONS:

Total number of plants and seed packets donated	125

PLANT DISTRIBUTION:

Plants distributed in exchange	16

HERBARIUM ACCESSIONS:

By Purchase—

Broadway, W. E.—Plants of Trinidad	110
Merrill, Dr. E. D.—Plants of southern Anam, Indo-China	176
Weigel, Theo. Oswald—J. Weese, "Eumycetes selecti exsiccati," Fasc. XXIII, Nos. 551-575 inclusive	25

By Gift—

Berkley, Earl E.—*Pinus palustris* Mill. and *P. Taeda* L. from Mississippi	2
Goodman, George J.—*Chorizanthe* sp. from Lower California	1
Merrill, Dr. E. D.—Plants of southern Anam, Indo-China	14
Santa Barbara Museum of Natural History by R. C. Robbins—*Chorizanthe insularis* Hoffmann from Santa Cruz Island, California	1
Steyermark, Julian A.—Vascular skeleton of catcus plant from California	1
Yale University School of Forestry by Samuel J. Record—*Duckeodendron cestroides* Kuhlm. from Brazil	1

By Exchange—

Berlin Botanical Museum—Photographic print of *Nymphaea Stuhlmannii* Stuhlmann & Gilg	1
Botanical Institute, University of Masaryk, Brno—"Flora Exsiccata Republicae Bohemicae Slovenicae," Cent. VIII, Nos. 701-800 inclusive	100
British Museum—Fragment of type of *Perictenia stipellaris* Miers from Peru	1
Pomona College by Professor P. A. Munz—*Parthenium alpinum* (Nutt.) T. & G. var. *ligulatum* Jones from Utah	1
U. S. National Museum—*Trachomitum venetum* (L.) Woodson from China	1
Total	435

SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date to the death of Mr. Shaw, in 1889, the Garden was maintained under the personal direction of its founder, and, while virtually a private garden, it was, except at certain stated times, always open to the public. Although popularly known as "Shaw's Garden" the name Missouri Botanical Garden was designated by Mr. Shaw as its official title and in his will or in any of his writings he specifically referred to it as the "Missouri Botanical Garden." By a provision of Mr. Shaw's will the Garden passed at his death into the hands of a Board of Trustees. The original members of the Board were designated in the will, and the Board so constituted, exclusive of certain ex-officio members, is self-perpetuating. By a further provision of the will, the immediate direction of the Garden is vested in a Director, appointed by the Board of Trustees. The Garden receives no income from city or state, but is supported entirely from funds left by the founder.

The city Garden comprises 75 acres, where about 12,000 species of plants are growing. There is now in process of development a tract of land of over 1,500 acres outside the city limits which is to be devoted to (1) the propagation and growing of plants, trees, and shrubs, designed for showing either indoors or outside, at the city Garden, thus avoiding the existing difficulties of growing plants in the city atmosphere; (2) gradually establishing an arboretum as well as holding a certain area as a forest reservation, with the idea that possibly at some future time this may become the new botanical garden.

The Garden is open to the public every day in the year, except New Year's Day and Christmas—week days from 8:00 a. m. until one-half hour after sunset; Sundays from 10 a. m. until sunset.

The main entrance to the Garden is located at Tower Grove Avenue and Flora Place, on the Sarah car line (No. 42). Transfer south from all intersecting lines. The Garden may also be reached by Bus Route No. 12, to which all other motor-bus lines transfer.

STAFF
OF THE MISSOURI BOTANICAL GARDEN

THE GARDEN, 2315 TOWER GROVE AVENUE, ST. LOUIS, MISSOURI

GEORGE T. MOORE,
Director

KATHERINE H. LEIGH,
Assistant to the Director

HERMANN VON SCHRENK,
Pathologist

CARROLL W. DODGE,
Mycologist

JESSE M. GREENMAN,
Curator of Herbarium

ROLAND V. LAGARDE,
Research Assistant

ERNEST S. REYNOLDS,
Physiologist

ROBERT E. WOODSON, JR.,
Research Assistant

NELL C. HORNER,
Librarian and Editor of Publications

GEORGE H. PRING,
Superintendent

JOHN NOYES,
Consulting Landscape Architect

PAUL A. KOHL,
Floriculturist

WILLIAM F. LANGAN,
Chief Engineer

JOHN H. KELLOGG,
Plant Collector

JOSEPH LANGEN,
Assistant Engineer

AUGUST P. BEILMANN,
Arboriculturist

ARTHUR D. FORRESTER,
Plant Recorder

JOSEPH CUTAK,
In charge of Exotics

ALBERT PEARSON,
Painter

LADISLAUS CUTAK,
In charge of Succulents

THE ARBORETUM, GRAY SUMMIT, MISSOURI

LARS P. JENSEN,
Manager

GUSTAVE GOEDEKE,
Foreman

DAVID MILLER,
Orchid Grower

ROY E. KISSECK,
Engineer

TROPICAL STATION, BALBOA, CANAL ZONE

A. A. HUNTER,
Manager

REPRESENTATIVE IN EUROPE

GURNEY WILSON, F. L. S.
Hove, Sussex, England

MISSOURI BOTANICAL GARDEN BULLETIN

Vol. XXI APRIL, 1933 No. 4

CONTENTS

	Page
When is the Best Time to Prune a Tree? (Maples) . .	61
Special Exhibit Illustrating Plant Responses	75
Notes	77
Statistical Information	79

ST. LOUIS, MO.
1933

Published Monthly, Except July and August, by the Board of Trustees

SUBSCRIPTION PRICE:

ONE DOLLAR PER YEAR SINGLE COPIES TEN CENTS

BOARD OF TRUSTEES
OF THE MISSOURI BOTANICAL GARDEN

THE ORIGINAL MEMBERS WERE DESIGNATED IN MR. SHAW'S WILL AND THE BOARD SO CONSTITUTED, EXCLUSIVE OF THE *EX-OFFICIO* MEMBERS, IS SELF-PERPETUATING

President
GEORGE C. HITCHCOCK

Vice-President
SAMUEL C. DAVIS

Second Vice-President
DANIEL K. CATLIN

L. RAY CARTER

ALBERT T. PERKINS

THOMAS S. MAFFITT

EUGENE PETTUS

GEORGE T. MOORE

ETHAN A. H. SHEPLEY

FRED G. ZEIBIG

EX-OFFICIO MEMBERS

GEORGE R. THROOP,
Chancellor of Washington University

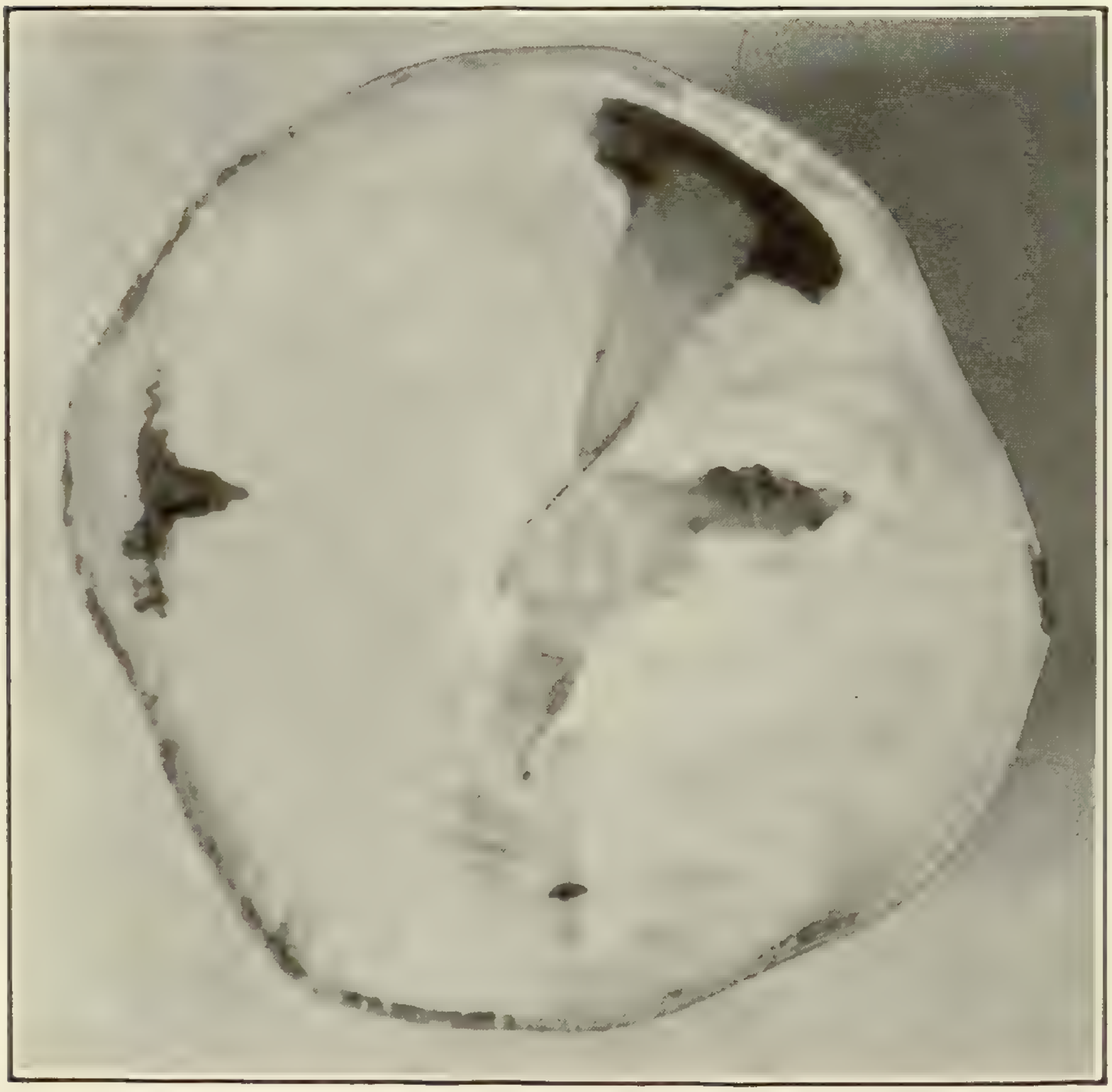
BERNARD F. DICKMANN,
Mayor of the City of St. Louis

FREDERICK F. JOHNSON,
Bishop of the Diocese of Missouri

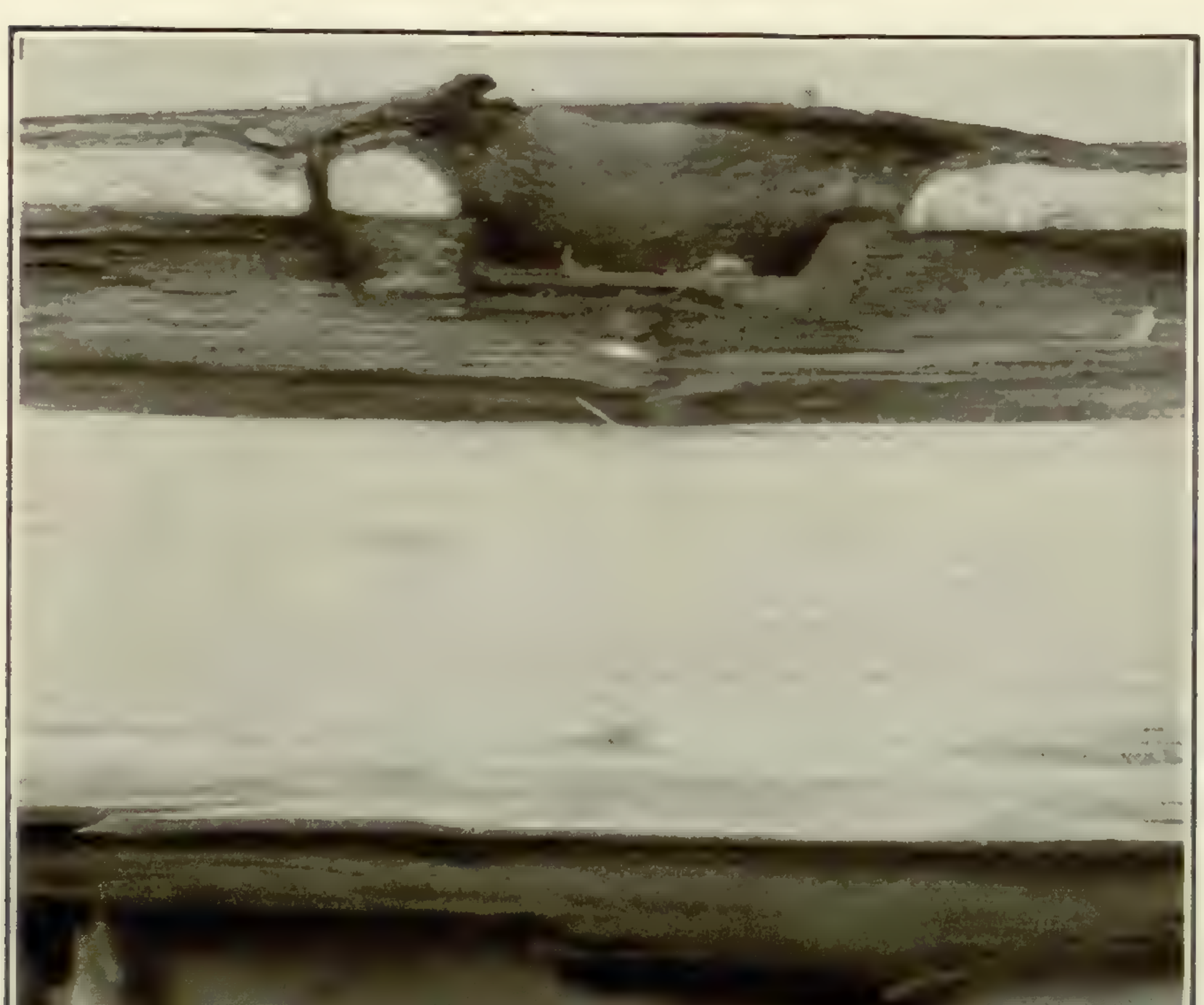
ALBERT KUNTZ,
President of The Academy of Science of St. Louis

DAVID C. TODD
President of the Board of Education of St. Louis

Secretary
GEORGE F. HEFFERNAN



CROSS SECTION OF TREE No. 9, SHOWING
NEARLY CIRCULAR GROWTH



LONGITUDINAL SECTION OF TREE No. 9,
SHOWING EXTENT OF DECAY

Missouri Botanical Garden Bulletin

Vol. XXI APRIL, 1933 No. 4

WHEN IS THE BEST TIME TO PRUNE A TREE? (MAPLES)

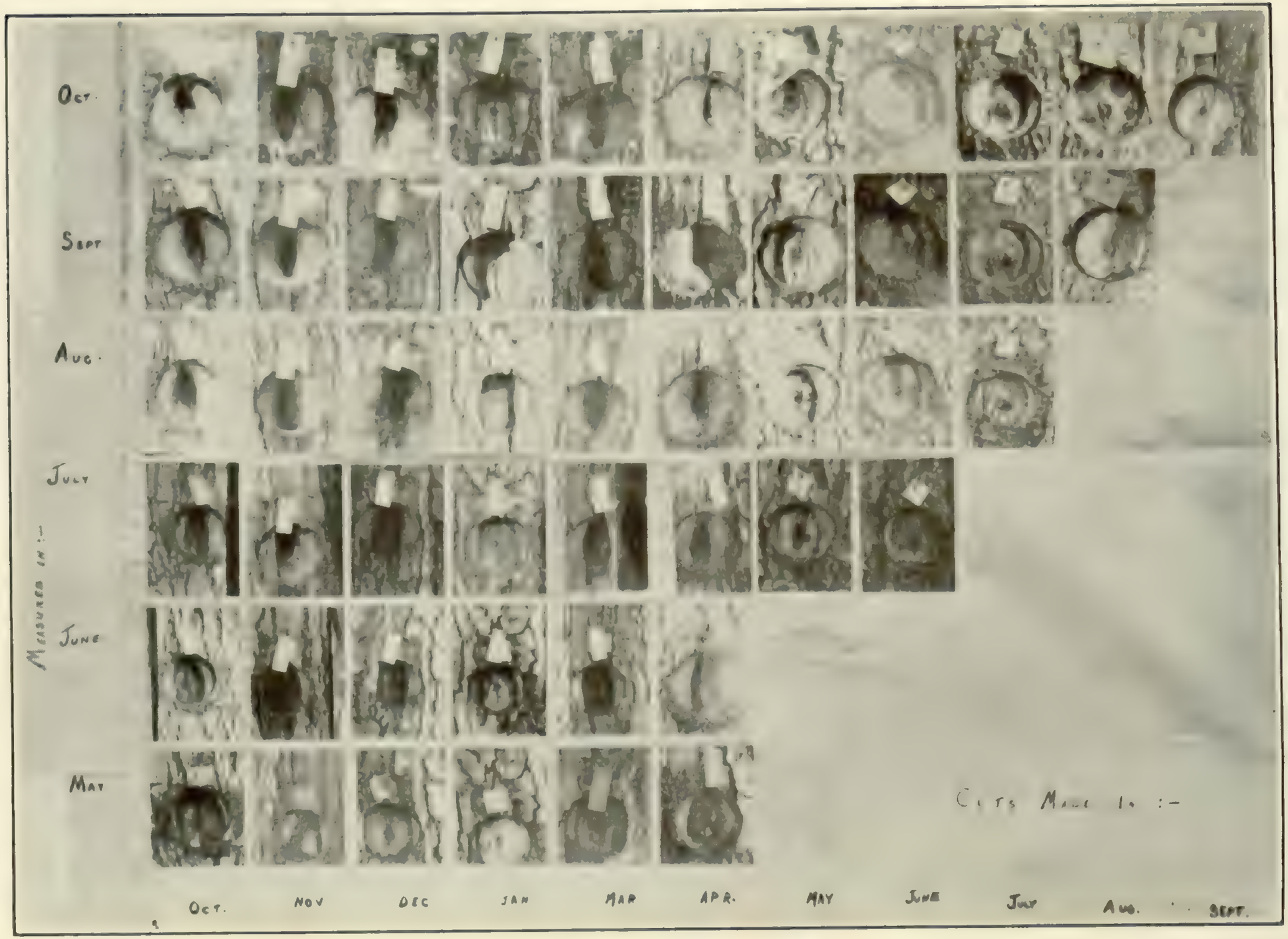
Custom has for a long time been our only guide in the selection of a proper time to prune. Some gardeners have advised us to prune in the dormant season; others, in the growing season; still others have told us to prune any time during the year, or whenever our "tools were sharp." Whether whispered as a secret or printed with authority, it becomes quite clear that there is little uniformity in our pruning practices.

If we accept the broad definition of the term "pruning" as the removal of any part of a tree, then it becomes the oldest of all horticultural practices. It dates back to a distant past when the first "tree doctor" rudely hewed away the branches obstructing his cave entrance, and it has established through the centuries an unenviable record showing no progress. The first "tree doctor" probably had the same pseudo-scientific knowledge and held the same mysterious communion with trees that so characterizes his modern counterpart. True, books and pamphlets have appeared telling us how, where, when, and why to prune, but application of the principles involved presupposes a close and extended observation of living trees. Moreover, authorities by no means agree, and proof that there is still much to be learned

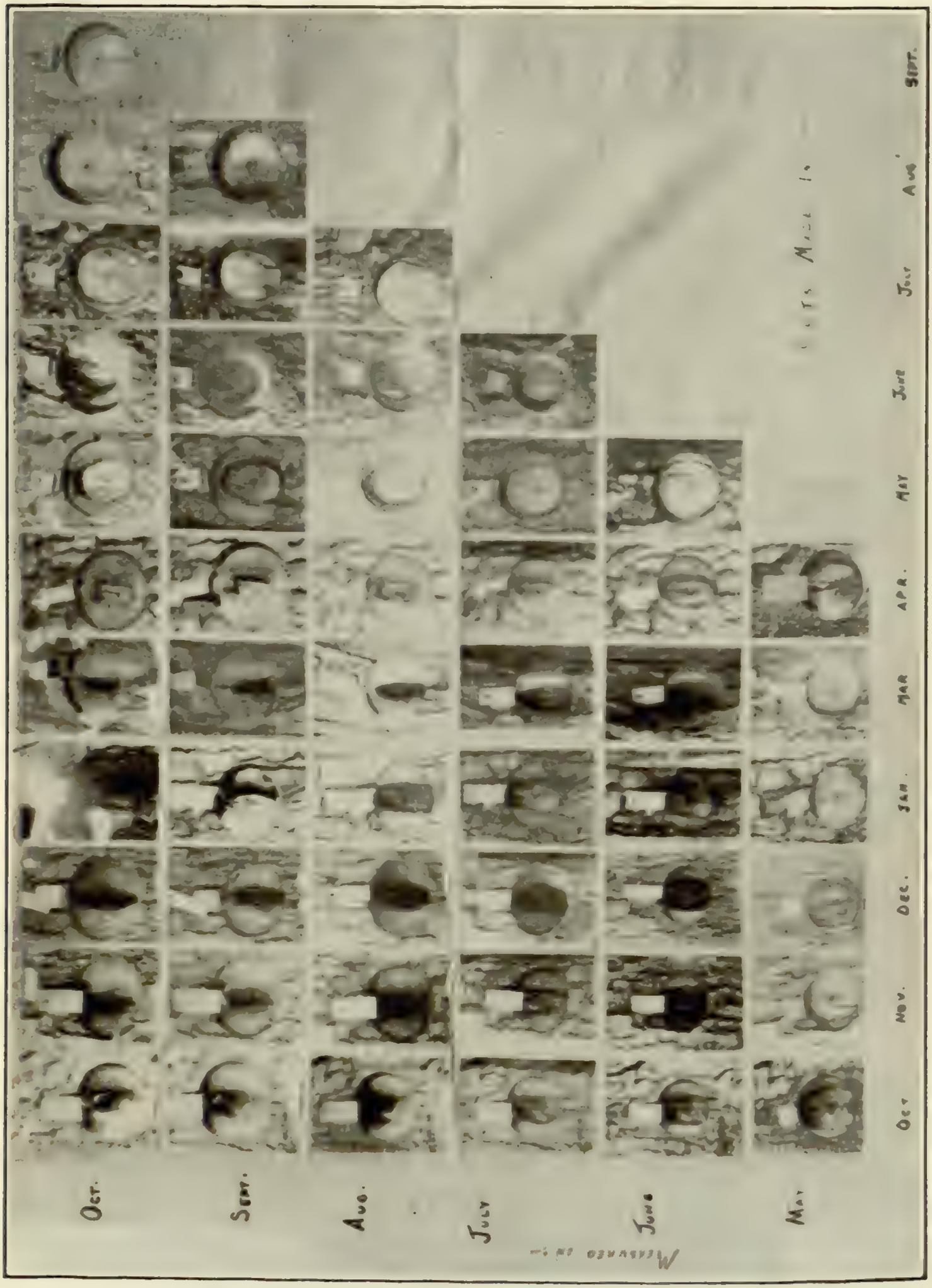
about pruning can be found wherever trees are growing. To the writer the word "pruning" brings up a troop of unanswered questions. Too much emphasis has been placed on mere observation, and it is obvious that only after many careful and periodic measurements have been made of numerous trees can the answer to these questions be given.

Nature has provided the tree with a corky armor called the bark. Just beneath this is the growing tissue or cambium, from which all wound callus or healing tissue originates. The location and function of both bark and cambium must always be remembered while pruning. While the bark is intact, few opportunities exist for the entrance of disease provided the tree is in good health. With the removal of a branch an opening in the armor occurs, and immediately a host of diseases, ranging from bacteria to the palisade fungi, enters to live unnoticed at the expense of the tree. Aided by a horde of insects, the collapse of such a tree is merely a matter of time. Not all diseases grow with the same vigor; in most cases a definite succession of fungi and insects plays its part in decay. Often fungi seem unable to progress faster than the tree grows. For centuries, perhaps, disintegration keeps pace with the annual increment, leaving only a shell of sound wood. Natural immunity, location, moisture, and a number of other factors combined are responsible for the hollow giants of a previous century. Very often these old hulks are shown to us as proof that decay cannot kill a tree. Happily they have been preserved from wind and sleet storms, but it might be well to inquire about the neighbors of these hollow veterans. How many trees have lived within sight of these giants and died from fungous attack? In the absence of a rule for predicting the rate of disintegration for a particular tree, precautions must be taken to protect the wood exposed by pruning. First, pruning must be done when callus growth is most rapid, and second, a permanent flexible dressing having some fungicidal value and uninjurious to the cambium must be used. The first requirement has not been given its full share of attention.

It must be understood that the term "pruning" as used hereafter means the removal of dead or live branches to cor-



TREATED CUTS



UNTREATED CUTS

rect some unhealthy condition or some structural weakness. Pruning should not be confused with "trimming," "pollarding," or any other form of tree butchery, so universally practiced. A trimmed tree is usually a decaying tree.

In an attempt to shed some light, however feeble, on the important question of pruning time, eleven silver maples (*Acer saccharinum* L.) were used in an experiment. These trees comprised part of an old nursery, and were all of the same age. They were as nearly alike as a group of twenty-two year old maples are likely to be, all being between eight and eleven inches in diameter, with clean trunks for at least eight feet. In addition, the soil in which they grew showed no marked difference. Since it is impossible to remove twenty-four branches from a tree in the course of a year for the purpose of measuring callus, it was necessary to make artificial pruning wounds. These would not change the growth rate and would be much easier to measure. Holes 38 mm. in diameter were made with an auger just deep enough to remove the cambium. The first holes were made October 18, 1931. Thereafter two holes were made each month, one of which was treated with shellac, the other left untreated. The first cuts were both ten inches above ground and five to seven inches apart. The next were six to eight inches higher and as much farther around the tree, this practice being continued for the whole twelve months.

Callus growth was first observed shortly before May 18, 1932, when the monthly measurements were begun. On this date the eighth set of cuts was made on all of the eleven trees. It is significant that callus growth does not begin with the opening of the buds but occurs from three to five weeks later. Late in the fall there is often a slight increase in diameter of a tree trunk which is manifest around the edge of a cut, but there is no rolling of a callus over a cut if it has been made after October first. Growth might be expected to begin at the top, and this of course would have some bearing on the accuracy of the measurements. However, there seems to be little evidence that growth at the bottom is retarded enough to invalidate the measurements. Few trees grow equally in all directions, and the normal growth of a particular area might be twice that of the opposite side. To

guard against any variation in measurements from this, one tree was cut down and sectioned (pl. 13, fig. 1) and the position of the pith determined. On four more an increment borer was used. In all cases a slightly greater growth occurred on the north side, but no great deviation from a circle was observed. Cuts No. 6, made March 18, show the most rapid healing, but are found on the north side no oftener than any other number. No pair of cuts occurs in exactly the same position on any two trees. They were sufficiently well distributed on nearly circular trees so that no allowance need be made for position. In addition to the measurements taken each month, all cuts on trees No. 1 and No. 2 were photographed (pls. 14 and 15) natural size. It seems, then, that 1,254 measurements of 264 cuts on 11 trees should yield some definite information regarding the most satisfactory time to prune. The following tables show the diametral closure in diameter of the original 38-mm. cut:

DIAMETER DECREASE FROM ORIGINAL 38-mm. CUT.

U=untreated cuts. T=treated cuts.

CUTS MADE IN	MEASURED IN											
	MAY		JUNE		JULY		AUG.		SEPT.		OCT.	
	U	T	U	T	U	T	U	T	U	T	U	T
Tree No. 1—	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*
October—No. 1	6	7	17	16	20	20	23	24	26	26	27	27
November—No. 2	6	6	16	19	20	23	25	27	28	30	28	30
December—No. 3	4	4	14	14	17	20	23	24	27	26	27	26
January—No. 4	4	6	11	17	12	18	16	20	18	22	18	22
February—No cuts.												
March—No. 5	5	5	14	16	18	21	23	27	24	30	24	30
April—No. 6	8	14	14	25	23	28	27	30	29	33	29	33
May—No. 7	...	...	4	6	8	11	8	14	12	18	16	18
June—No. 8	...	...	...	...	5	6	11	12	17	17	17	18
July—No. 9	...	...	...	...	...	...	3	6	9	13	9	14
August—No. 10	...	...	...	...	...	...	...	...	2	3	3	3
September—No. 11	...	...	...	...	...	...	...	...	...	...	0	0

DIAMETER DECREASE FROM ORIGINAL 38-mm. CUT.

U=untreated cuts. T=treated cuts.

CUTS MADE IN	MEASURED IN											
	MAY		JUNE		JULY		AUG.		SEPT.		OCT.	
	U	T	U	T	U	T	U	T	U	T	U	T
Tree No. 2—	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*
October—No. 1	6	5	15	20	18	25	23	30	28	35	28	35
November—No. 2	5	6	17	17	21	22	28	27	30	32	31	33
December—No. 3	3	4	11	14	13	18	18	24	21	28	21	28
January—No. 4	4	4	13	17	17	20	22	26	26	28	26	28
February—No cuts.												
March—No. 5	4	4	12	17	14	20	21	26	23	30	24	30
April—No. 6	6	8	18	22	20	27	25	33	29	36	29	37
May—No. 7	...	...	3	7	8	8	15	14	19	18	19	20
June—No. 8	...	...	...	...	3	5	10	13	16	18	18	18
July—No. 9	...	...	...	...	...	...	4	5	10	10	11	10
August—No. 10	...	...	...	...	...	...	...	...	3	4	4	5
September—No. 11	...	...	...	...	...	...	...	...	...	...	0	0
Tree No. 3—	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*
October—No. 1	6	7	16	18	18	21	22	27	24	31	25	31
November—No. 2	3	4	16	13	18	16	24	20	27	23	28	24
December—No. 3	2	3	8	9	10	11	11	13	14	13	13	14
January—No. 4	4	3	14	11	20	15	22	17	25	19	26	20
February—No cuts.												
March—No. 5	2	4	9	10	10	10	14	13	16	15	16	15
April—No. 6	5	10	16	21	20	25	25	33	28	37	28	37
May—No. 7	...	...	7	4	7	5	12	5	15	5	15	5
June—No. 8	...	...	...	...	3	5	8	12	12	16	13	16
July—No. 9	...	...	...	...	...	...	5	3	8	8	8	8
August—No. 10	...	...	...	...	...	...	...	...	2	2	3	3
September—No. 11	...	...	...	...	...	...	...	...	...	...	0	0

DIAMETER DECREASE FROM ORIGINAL 38-mm. CUT.

U=untreated cuts. T=treated cuts.

CUTS MADE IN	MEASURED IN											
	MAY		JUNE		JULY		AUG.		SEPT.		OCT.	
	U	T	U	T	U	T	U	T	U	T	U	T
Tree No. 4—	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*
October—No. 1	7	7	19	17	22	23	28	30	32	34	32	34
November—No. 2	3	5	13	17	14	18	18	27	18	30	19	30
December—No. 3	4	3	15	13	17	13	21	19	23	22	23	23
January—No. 4	1	3	12	12	14	15	19	20	21	23	21	24
February—No. 5	4	3	12	10	12	11	18	15	19	18	19	18
March—No. 6	6	8	17	20	20	24	26	30	30	34	30	34
April—No. 7	2	...	4	...	13	...	20	...	24	...	24	inj.
May—No. 8	...	...	1	4	3	6	11	11	11	12	11	12
June—No. 9	...	...	...	...	2	5	8	9	12	11	12	12
July—No. 10	...	...	...	...	...	...	5	5	10	7	10	8
August—No. 11	...	...	...	...	...	...	...	...	3	3	3	3
September—No. 12	...	...	...	...	...	...	...	...	...	...	0	0
Tree No. 5—	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*
October—No. 1	6	8	17	16	18	17	23	23	24	23	24	23
November—No. 2	3	5	12	10	14	10	17	13	18	15	18	15
December—No. 3	3	5	11	13	12	15	15	20	16	23	16	24
January—No. 4	3	4	8	13	10	14	12	19	12	19	12	19
February—No. 5	4	5	15	12	17	15	22	21	22	22	23	23
March—No. 6	7	11	13	19	16	20	22	24	23	26	23	26
April—No. 7	0	6	13	17	13	20	16	25	18	25	19	25
May—No. 8	...	...	3	5	5	7	11	9	12	9	12	9
June—No. 9	...	...	...	...	4	4	10	9	12	11	12	11
July—No. 10	...	...	...	...	...	...	5	4	8	6	9	7
August—No. 11	...	...	...	...	...	...	...	...	2	5	4	5
September—No. 12	...	...	...	...	...	...	...	...	...	...	0	0

DIAMETER DECREASE FROM ORIGINAL 38-mm. CUT.

U=untreated cuts. T=treated cuts.

CUTS MADE IN	MEASURED IN											
	MAY		JUNE		JULY		AUG.		SEPT.		OCT.	
	U	T	U	T	U	T	U	T	U	T	U	T
Tree No. 6—	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*
October—No. 1	3	5	12	12	15	14	17	18	19	20	19	20
November—No. 2	1	0	7	7	8	8	11	9	14	11	14	12
December—No. 3	1	2	9	7	9	8	10	10	11	11	11	12
January—No. 4	2	1	7	10	8	11	8	14	8	14	8	14
February—No. 5	2	2	12	8	13	9	16	10	17	12	18	12
March—No. 6	0	7	6	14	7	16	7	20	7	23	9	24
April—No. 7	0	1	4	11	6	14	11	17	12	19	12	19
May—No. 8	...	...	3	4	5	5	6	7	8	9	8	9
June—No. 9	...	...	...	...	1	3	4	5	4	6	4	6
July—No. 10	...	...	...	...	...	...	3	3	6	5	6	5
August—No. 11	...	...	...	...	...	...	...	...	2	2	2	2
September—No. 12	...	...	...	...	...	...	...	...	...	...	0	0
Tree No. 7—	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*
October—No. 1	4	6	19	19	22	22	26	30	30	36	30	36
November—No. 2	2	2	14	12	17	13	19	18	22	20	23	20
December—No. 3	1	2	9	12	13	15	14	18	15	21	16	21
January—No. 4	1	1	13	10	16	13	21	15	23	13	23	15
February—No. 5	2	3	11	15	13	18	15	21	17	24	17	25
March—No. 6	5	8	17	27	18	29	23	37	25	37	25	38
April—No. 7	0	1	10	15	13	18	18	25	21	27	21	27
May—No. 8	...	...	5	7	8	9	13	15	15	16	16	17
June—No. 9	...	...	...	...	2	1	8	6	11	6	12	7
July—No. 10	...	...	...	...	...	...	3	4	8	5	8	5
August—No. 11	...	...	...	...	...	...	...	...	1	3	1	3
September—No. 12	...	...	...	...	...	...	...	...	...	...	0	0

DIAMETER DECREASE FROM ORIGINAL 38-mm. CUT.

U=untreated cuts. T=treated cuts.

CUTS MADE IN	MEASURED IN											
	MAY		JUNE		JULY		AUG.		SEPT.		OCT.	
	U	T	U	T	U	T	U	T	U	T	U	T
Tree No. 8—	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*
October—No. 1	2	2	9	10	11	11	12	13	13	15	14	15
November—No. 2	0	2	10	12	12	14	14	17	15	20	16	21
December—No. 3	1	2	8	7	11	7	12	8	15	10	15	10
January—No. 4	0	1	7	9	9	13	9	17	11	19	11	19
February—No. 5	0	0	7	8	9	9	11	11	13	14	14	14
March—No. 6	3	7	11	23	11	27	14	32	18	35	18	35
April—No. 7	0	0	8	9	9	9	13	14	16	17	17	17
May—No. 8	...	...	1	3	3	4	7	12	8	13	9	13
June—No. 9	...	...	...	...	2	2	5	5	8	6	8	6
July—No. 10	...	...	...	...	...	...	2	1	6	4	6	5
August—No. 11	...	...	...	...	...	...	...	...	1	2	1	3
September—No. 12	...	...	...	...	...	...	...	...	...	...	0	0
Tree No. 9—	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*
October—No. 1	3	5	13	13	16	16	21	19	23	22	23	22
November—No. 2	1	2	8	8	9	11	10	14	14	16	14	17
December—No. 3	0	2	7	8	8	8	11	11	13	14	13	14
January—No. 4	0	0	9	8	9	11	13	15	16	15	16	17
February—No. 5	2	1	11	7	14	9	17	11	20	13	20	13
March—No. 6	3	5	13	17	17	19	21	23	24	27	24	29
April—No. 7	1	1	9	12	11	15	16	20	19	24	19	24
May—No. 8	...	...	6	5	6	5	11	8	14	12	14	12
June—No. 9	...	...	...	...	1	2	7	7	10	9	11	10
July—No. 10	...	...	...	...	...	...	3	2	6	5	6	6
August—No. 11	...	...	...	...	...	...	...	...	1	2	2	3
September—No. 12	...	...	...	...	...	...	...	...	...	...	0	0

DIAMETER DECREASE FROM ORIGINAL 38-mm. CUT.

U=untreated cuts. T=treated cuts.

CUTS MADE IN	MEASURED IN											
	MAY		JUNE		JULY		AUG.		SEPT.		OCT.	
	U	T	U	T	U	T	U	T	U	T	U	T
Tree No. 10—	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*
October—No. 1	5	5	17	18	21	29	26	29	31	32	32	33
November—No. 2	0	3	8	13	13	13	16	19	19	23	20	23
December—No. 3	4	1	11	9	13	10	18	15	20	19	20	19
January—No. 4	2	5	14	13	19	18	27	25	31	29	31	29
February—No. 5	3	3	11	11	13	11	17	20	19	24	19	24
March—No. 6	5	7	13	18	17	24	27	30	33	26	34	37
April—No. 7	1	2	7	14	9	19	14	28	20	32	22	32
May—No. 8	...	...	9	9	13	19	23	24	29	31	29	32
June—No. 9	...	...	...	...	3	5	10	12	15	15	16	16
July—No. 10	...	...	...	...	...	...	6	5	14	9	14	10
August—No. 11	...	...	...	...	...	...	...	...	3	3	5	4
September—No. 12	...	...	...	...	...	...	...	...	...	...	0	0
Tree No. 11—	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*	*mm.*
October—No. 1	...	...	19	20	24	24	32	33	35	36	36	37
November—No. 2	...	...	13	17	17	21	23	25	28	29	29	30
December—No. 3	...	...	8	15	11	20	16	28	19	31	20	32
January—No. 4	...	...	10	14	15	20	22	28	25	32	25	32
February—No. 5	...	...	12	14	16	20	24	28	28	32	28	33
March—No. 6	...	...	19	23	20	28	29	35	29	27	31	38
April—No. 7	...	...	15	17	17	22	25	31	32	35	33	36
May—No. 8	...	...	4	7	8	10	16	17	21	22	21	22
June—No. 9	...	...	...	...	4	5	12	13	18	19	19	20
July—No. 10	...	...	...	...	...	...	5	7	12	16	13	18
August—No. 11	...	...	...	...	...	...	...	...	2	2	3	3
September—No. 12	...	...	...	...	...	...	...	...	...	...	0	0

It is evident from the accompanying charts and table that a pruning cut 38 mm. wide, if made between March 18 and April 18, will be very nearly closed by callus growth before winter. A pruning wound made in March will heal as much in seven months as one made in October will heal in an entire year. This is of considerable importance, the

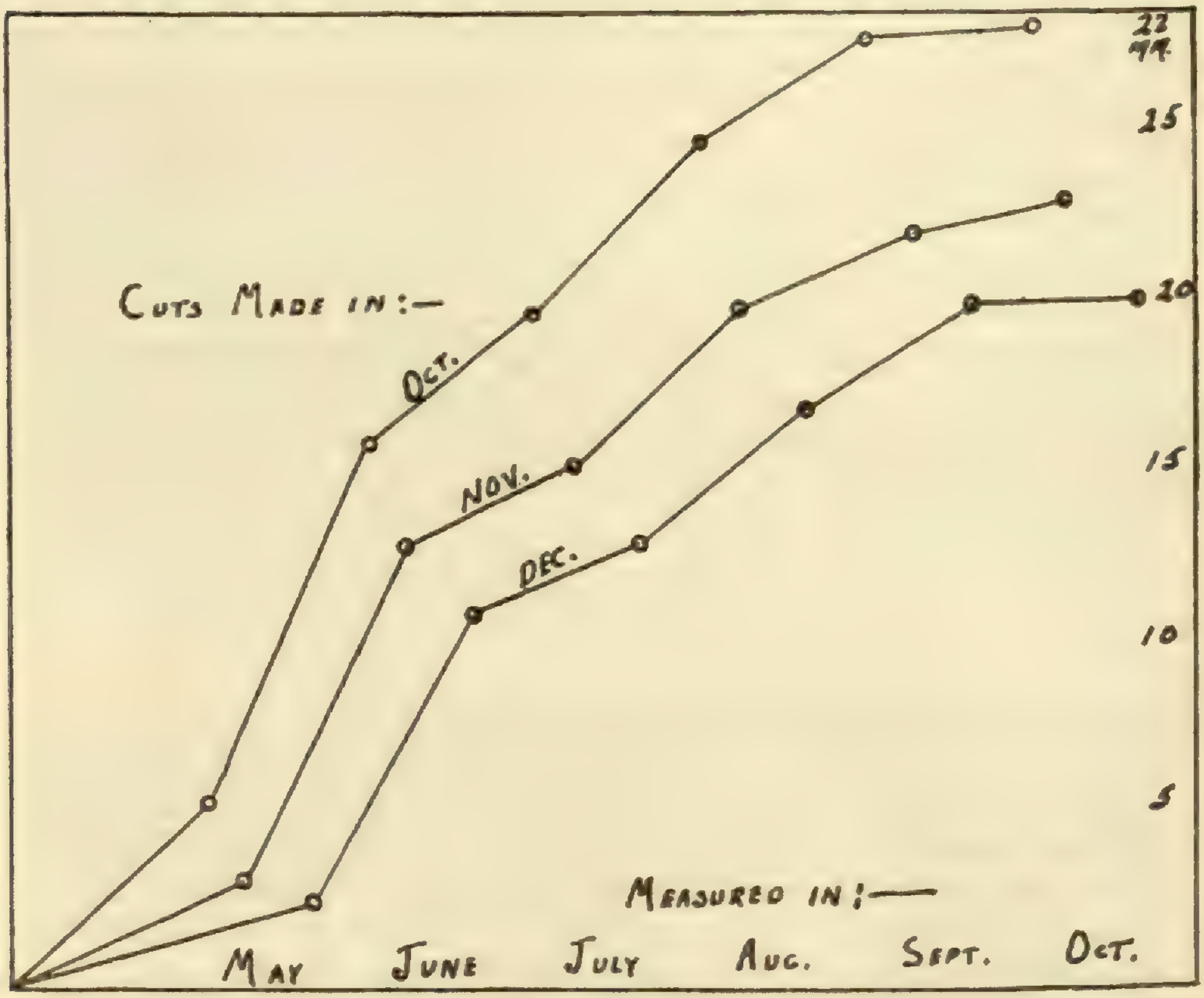


CHART No. 1

underlying wood being exposed to infection only 59 per cent as long as the spring cuts. The growth rate after March very gradually decreases until fall, and the cuts made in September showed no more healing before winter. To continue the measurements until the wound closed completely would have required part of another growing season. The second summer

would introduce a different growing rate, and would give some cuts an advantage not enjoyed by similar cuts the previous year. It is more accurate in the case of the late summer cuts (August and September) to add to their 1932 closure the average closure recorded for October. The second year would certainly differ from the previous season, neces-

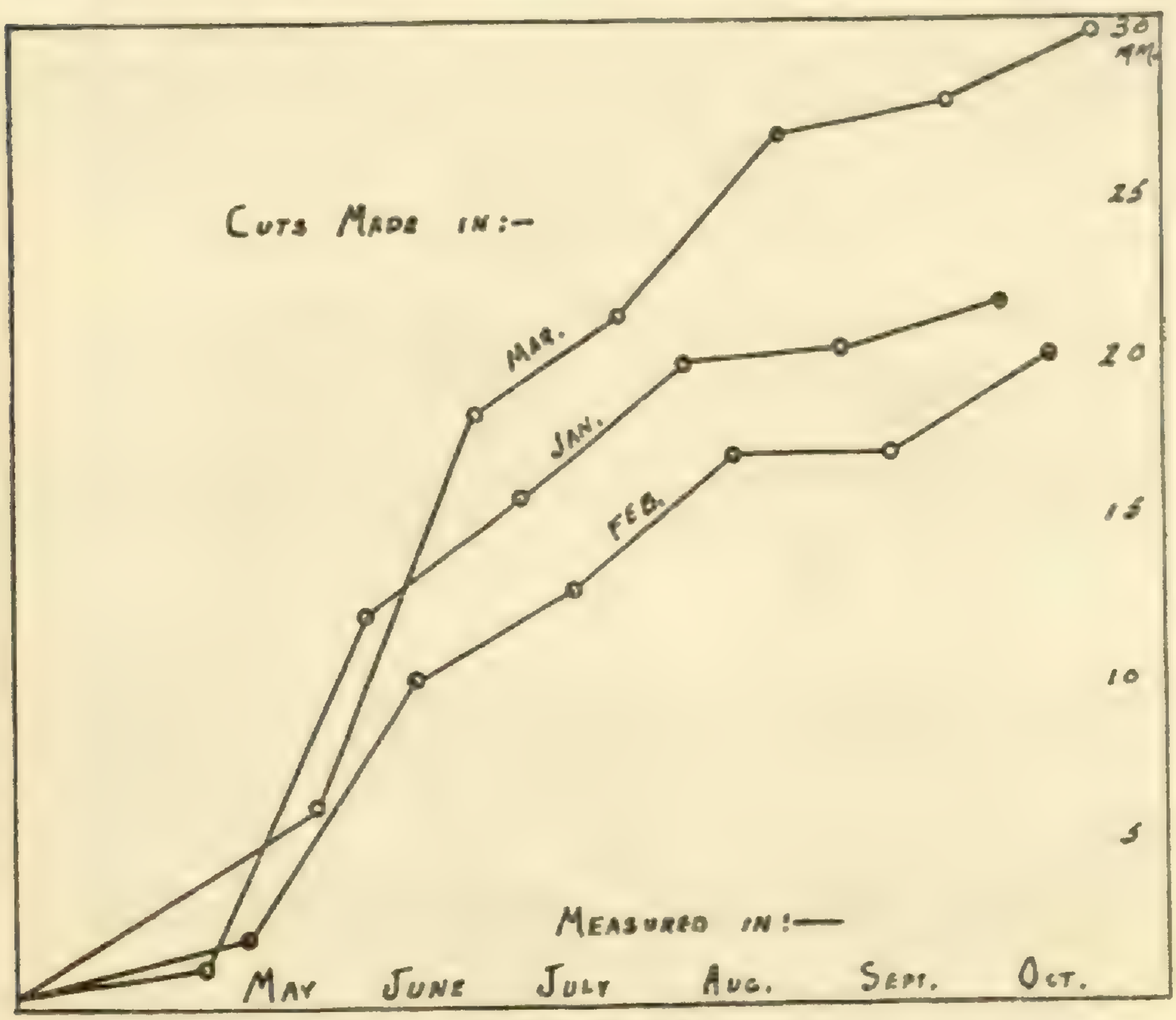


CHART No. 2

sitating some allowance which would be quite impossible.

In addition to the rapid healing enjoyed by the spring cuts it will be seen from the accompanying plates (pls. 14-15) that winter pruning favors a very severe dying back of the cambium. This dying back causes the cut to assume a somewhat diamond shape, exposing additional sap-wood, as

great in area as that of the original cut. This occurs throughout November but disappears after March first. During the summer the healing wound becomes more and more circular. Callus from the shellac-treated cuts covered about 10 per cent more of the exposed wood in the same time as those untreated, this being especially noticeable in winter. This would indicate that some dressing capable of protecting the

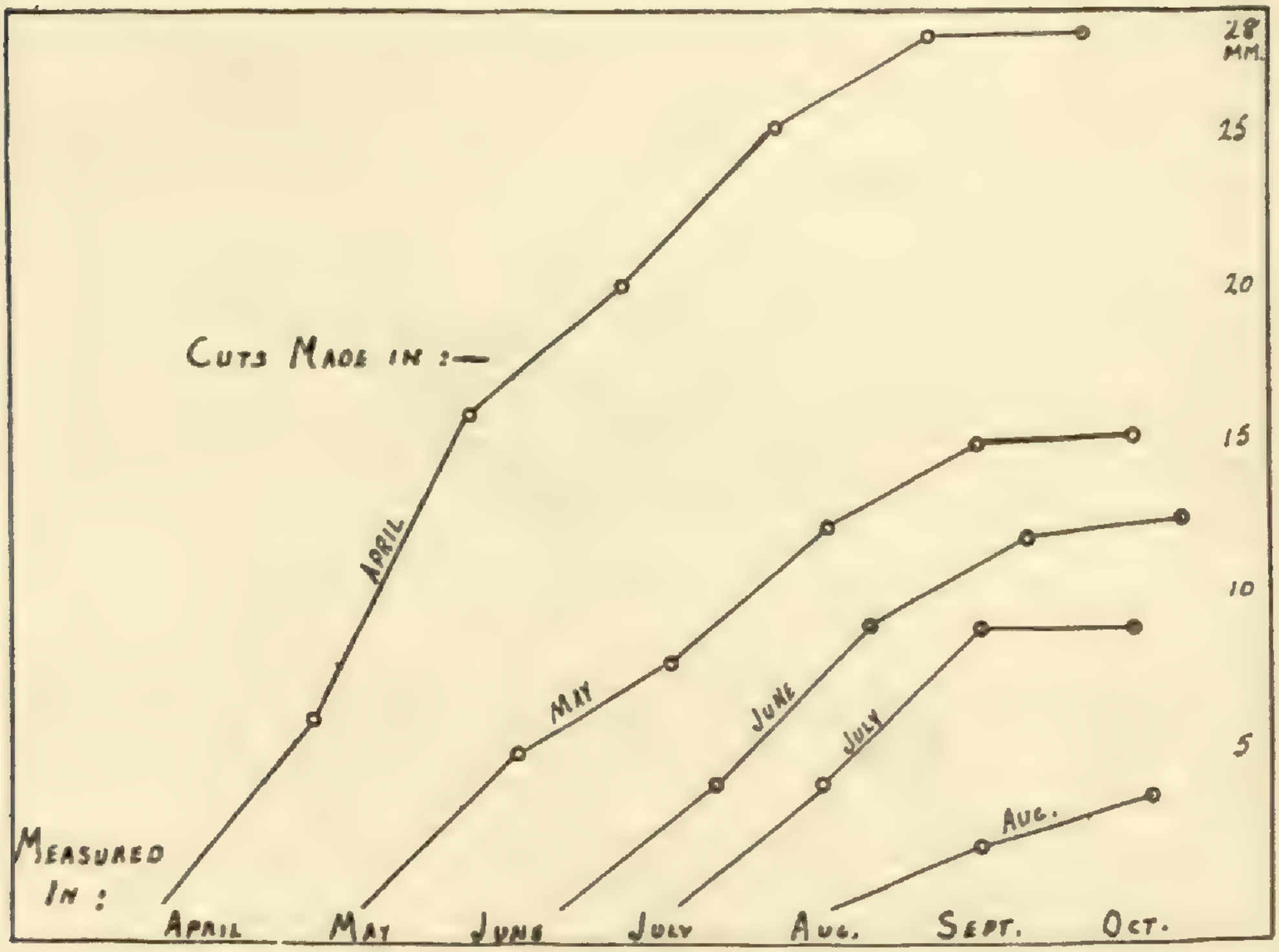


CHART No. 3

cambium should be used whenever trees are pruned. Shellac is of considerable value, but it will not prevent the entrance of wood-destroying fungi. Tree No. 9 which was sectioned shows the extent of discolored wood in the region of the cuts (pl. 13, fig. 2). In early spring, maples are subject to severe bleeding, this being reflected in the retarded callus growth for February. While little or no harm would result from pruning at that time, it would be very difficult to apply

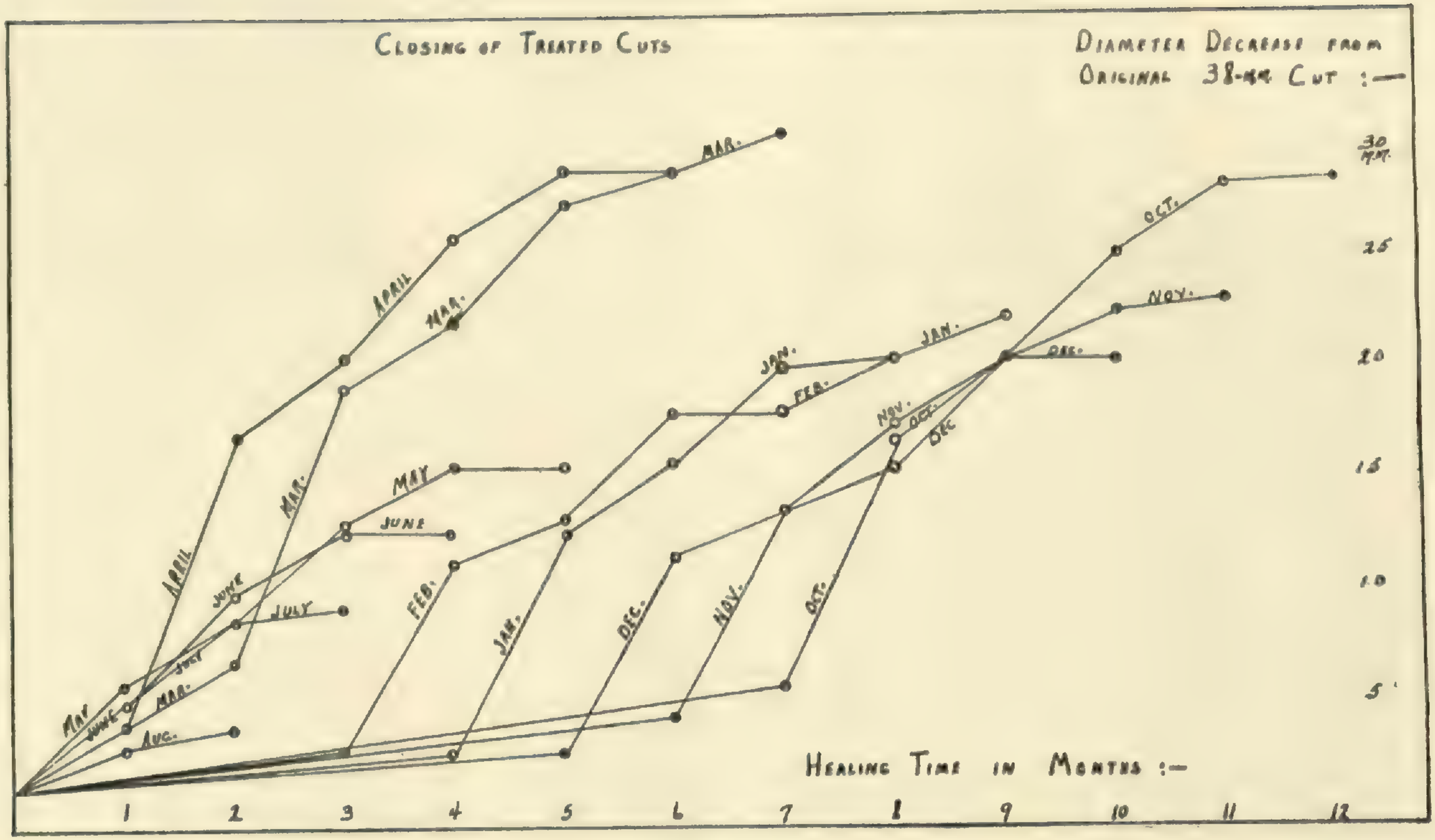

Closing of Treated Cuts
Diameter Decrease from Original 38-mm Cut :—
30 mm.
25
20
15
10
5
Healing Time in Months :—
1 2 3 4 5 6 7 8 9 10 11 12
April
Mar.
May
June
July
Aug.
Jan.
Feb.
Nov.
Oct.
Dec.

CHART No. 4

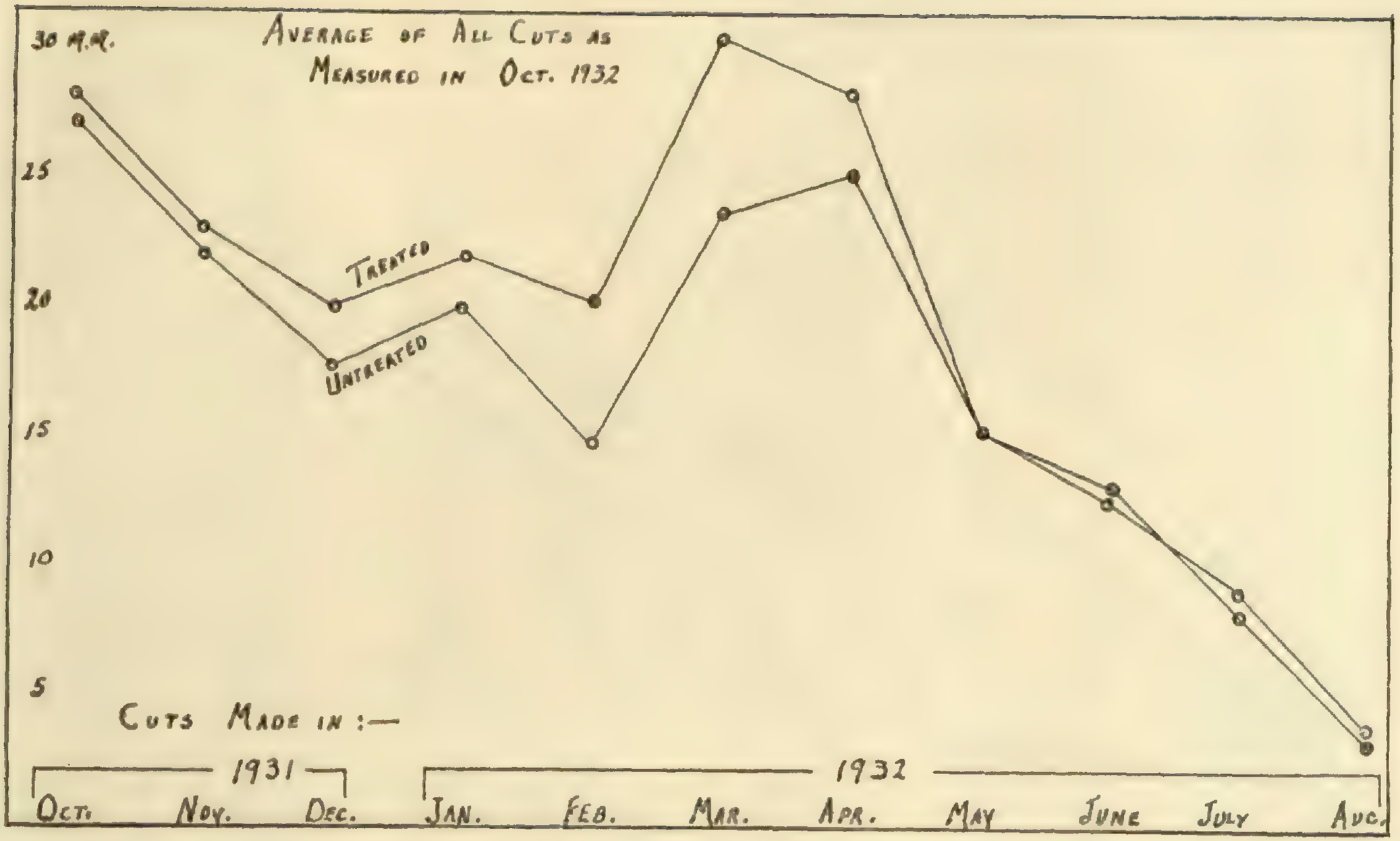

AVERAGE OF ALL CUTS AS MEASURED IN OCT. 1932
30 M.M.
25
20
15
10
5
TREATED
UNTREATED
CUTS MADE IN :—
1931
1932
OCTO.
NOV.
DEC.
JAN.
FEB.
MAR.
APR.
MAY
JUNE
JULY
AUG.

CHART No. 5

a protective dressing. After March 18 little or no bleeding occurs, depending, of course, upon the season, but should bleeding occur then it would be advisable not to prune until it had stopped.

It seems reasonable to assume from the work described that maples in this vicinity should be pruned between March 18 and April 18. It has also been shown that some protective dressing is necessary to prevent drying of the exposed cambium. Perhaps any tree might be pruned at the same time as the maple, but until other contemplated work is finished the results reported should be applied to maples only.

A. P. B.

SPECIAL EXHIBIT ILLUSTRATING PLANT RESPONSES

The members of the Society of American Florists and Ornamental Horticulturists attending the forty-ninth annual convention were entertained at luncheon in the floral display house on March 30. A special exhibit illustrating responses of plants to various environmental conditions was prepared for the occasion, and because of the interest manifested will remain on display for several weeks longer. Listed below are brief explanations of the exhibits:

Exhibit A.—Trophies won by the Missouri Botanical Garden. Medals and cups. National recognition accorded the Garden.

Exhibit B.—Progressive stages in orchid culture. The complete life history of the orchid is shown, from the development of the seed to the mature plant. Symbiotic and asymbiotic methods.

Exhibit C.—Plant nutrition. Garden peas grown in water cultures to which various plant nutrients have been added. Note the variations which occur in the root and top growths when certain nutritive elements are lacking in the cultures.

Exhibit D.—Seed germination. Seeds planted in various soil, peat, and sand mixtures show large differences in rapidity and percentage of germination. Temperature is also a very important factor in germination. Seeds of "cool crops" germinate readily at temperatures low enough to prevent completely the germination of seeds of "warm crops."

Exhibit E.—Translocation of mineral elements in the plant. The close relationship of the root system to the top growth of the plant is demonstrated. The lower end of the stem is split lengthwise and one-half the root system planted in pure sand; the other half in fertile soil. Note the well developed top growth on the side that has the roots in soil, while on the other side with roots in sand the top growth is dwarfed. This indicates that the leaves and branches of a plant are supplied with mineral elements by that part of the root system immediately below them. In other words, one side of a plant may be undernourished while the other side may be well supplied, depending on the root system.

Exhibit F.—Growth responses in various types of plant containers. Plants can be grown in many kinds of containers other than the standard clay pot. Glazed pots, painted pots, jardinieres, tin cans, etc., may be used successfully if water is applied sparingly. The standard clay pot is porous and permits rapid evaporation, but with non-porous containers the water is retained much longer and careful watering is necessary.

Exhibit G.—Effect of acidity and alkalinity on plant growth. Ordinary compost soil was used with aluminum sulphate and slaked lime to regulate the acidity and alkalinity of the cultures.

Exhibit H.—Plant growth in air-tight containers. The plants on display have been growing in the sealed containers for several months and appear quite normal. The containers are sealed with paraffin and shellac. Vaseline is used as a seal around the stems. Water is added when necessary through the separatory funnel at the top of the pot and the excess drained off through the glass tube at the bottom.

Exhibit I.—Desert landscape.

Exhibit J.—Flowers preserved in sand. Flowers are cut fresh and buried completely in fine, clean sand. With proper care the sand can be poured around the flowers without injuring their natural shape. After three to four weeks the sand is sifted off and the dried specimens removed. The sand particles which adhere to the flowers may be carefully brushed off. Flowers preserved by this method will retain their color and shape indefinitely if not exposed to the sun and wind.

Exhibit K.—Growth responses of pot-bound plants. A series of plants were permitted to become severely pot-bound, while the check plants were grown in larger containers with root systems not restricted. Note the tendency of pot-bound plants to flower early and produce inferior growth.

Exhibit L.—Photoperiodism. "Long-day" plants may be stimulated into vigorous growth and early flowering by using electric light to supplement the short days of winter. The treated plants

received four hours additional light from 6 to 10 p. m. for 30 days, using 100-watt lamps. The check plants were exposed to normal daylight and received no additional illumination.

Exhibit M.—Influence of X-rays on plant growth. Brief exposure of dry seeds, sprouted seeds, and plants to X-rays retarded root and top growth. Plants may be severely injured by long exposures to X-rays.

Exhibit N.—Succulent seedlings, grafts, and noteworthy specimens. This collection includes such novelties as "tiger's jaw," "living rock," "old man cactus," "mescal button," "sheep's foot," "rat-tail cactus," "little pickles," "pin cushion," "prickly pear," "barrel cactus," "organ pipe," etc.

Exhibit O.—Growth responses in various rooting media. The relative values of soil, peat, sand, and sawdust as mediums for plant growth are shown. The geraniums were grown in the pots from rooted cuttings and the calendulas from seedlings.

Exhibit P.—Bubble bouquets. A bubble bouquet is nothing more than an ordinary, simple bouquet of flowers entirely submerged in water. The respiration of the flower tissue produces the bubbles on the bouquet.

Exhibit Q.—Progressive stages in water-lily culture. The hybridization, germination, propagation, and development of the mature water-lily plants.

NOTES

Dr. D. C. Fairburn spoke before the Parent-Teacher Association of the Valley School, Maplewood, Mo., April 17, on "Home Gardening."

Dr. George T. Moore, Director of the Garden, spoke before the Business Women's Club of St. John's Methodist Church, April 19, on "Henry Shaw and His Garden"; and before the Gamma Alpha Fraternity, University of Missouri, April 27, on "Some Inside Facts About Plants."

On March 30 the delegates and their wives attending the convention of the Society of American Florists and Ornamental Horticulturists were guests of the Garden. After a luncheon in the floral display house the ladies were conducted on a tour of the grounds and buildings.

Mr. L. P. Jensen, Manager Missouri Botanical Garden Arboretum, spoke at the Gray Summit School at the Tree Planting and Arbor Day celebration, April 7, on "The Significance of Arbor Day"; and at a tree-planting demonstration at the high school grounds, Washington, Mo., April 19, on "How to Plant and Care for Trees."

Recent visitors to the Garden include Dr. Delzie Demaree, formerly assistant professor of botany, University of Arkansas; Prof. Alex Laurie, head department of floriculture, Ohio State University, Columbus, Ohio, with a party of his students; Dr. E. J. Wilde, professor of ornamental horticulture, Pennsylvania State College, State College, Penn.; Dr. A. Stark, research assistant, Iowa State College, Ames, Iowa.

Mr. George H. Pring, Superintendent of the Garden, spoke before the Wednesday Club of East St. Louis, April 5, on "Planting City Gardens"; at a luncheon at the Young Men's Christian Association, April 13, on "The Romance of Our Native Flora"; before a meeting of the Holly Hills Improvement Association, April 18, on "How to Plant a City Garden"; before the Carlinville Women's Club, Carlinville, Ill., April 20, on "Home Gardens."

The first number of Volume XX of the ANNALS OF THE MISSOURI BOTANICAL GARDEN has been issued with contents as follows: "A New Yellow Nymphaea from Tropical Africa," George H. Pring and Robert E. Woodson, Jr.; "Contribution to the Lichen Flora of North America," Veli J. P. B. Räsänen; "Astranthium and Related Genera," Esther L. Larsen; "Ferns and Fern Allies of Missouri," M. Elizabeth Pinkerton; "Blastomycosis: Report of a Case, with a Study of an Etiologic Factor and a Classification of the Organism," Morris Moore; "A Monograph of the American Species of the Genus Halenia," Caroline K. Allen; "The Sensitivity of Orchid Seedlings to Nutritional Ions," F. Lyle Wynd.

STATISTICAL INFORMATION FOR MARCH, 1933

GARDEN ATTENDANCE:
Total number of visitors.....18,675

LIBRARY ACCESSIONS:
Total number of books and pamphlets bought..... 62
Total number of books and pamphlets donated..... 192

PLANT ACCESSIONS:
Total number of plants and seed packets donated..... 169

HERBARIUM ACCESSIONS:

By Purchase—
Lawrance, Alexander E. — Plants of Colombia, South America 207
Rick, Rev. J.—Plants of Brazil..... 569
Samuelsson, Dr. Gunnar—Plants of South America.... 245
White, J. J.—Plants of British Honduras..... 126

By Gift—
Baxter, Edgar — Photographs of *Opuntia congesta* Griffiths 2
Dodge, Dr. C. W.—Plants of Panama and Costa Rica.. 24
Lodewyks, Miss Maude—*Pinus* sp. from horticulture... 1
Peirson, Frank W.—Plants of California..... 3
Räsänen, Veli—Plants of British Columbia and Finland. 30
Rambo, Balduin—Plants of Brazil..... 10
Sharp, Ward M.—*Scytonema alatum* (Car.) Bor. from Missouri 1
Steyermark, Julian A.—Plants of Missouri..... 5
von Schrenk, Dr. Hermann—Plants of Mexico..... 5
Whetzel, H. H.—Plant of Pennsylvania..... 1

By Exchange—
Arnold Arboretum—Plants of the United States collected by E. J. Palmer..... 235
Botanical Museum, Oslo, Norway—Plants of Norway... 34
Royal Botanic Gardens, Kew, England — Photographs and fragments of types..... 5
U. S. Department of Agriculture, Washington, D. C. by Dr. S. F. Blake—Plants of Virginia and Maryland. 3
University of Missouri, Department of Botany by Mr. Francis Drouet—Algae of Missouri, Quebec, etc..... 35
University of Wisconsin, Department of Botany by Dr. N. C. Fassett—Plants of Wisconsin, etc..... 300
University of Wyoming, Department of Botany by Professor A. Nelson—Plants of Wyoming, Colorado, New Mexico, and Arizona..... 387
University of Wyoming, Department of Botany by Mr. Louis Williams—Plants of Wyoming..... 2

By Transfer—
Pring, George H.—*Senecio confusus* Britten from horticulture 1

Total 2231

SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date to the death of Mr. Shaw, in 1889, the Garden was maintained under the personal direction of its founder, and, while virtually a private garden, it was, except at certain stated times, always open to the public. Although popularly known as "Shaw's Garden" the name Missouri Botanical Garden was designated by Mr. Shaw as its official title and in his will or in any of his writings he specifically referred to it as the "Missouri Botanical Garden." By a provision of Mr. Shaw's will the Garden passed at his death into the hands of a Board of Trustees. The original members of the Board were designated in the will, and the Board so constituted, exclusive of certain ex-officio members, is self-perpetuating. By a further provision of the will, the immediate direction of the Garden is vested in a Director, appointed by the Board of Trustees. The Garden receives no income from city or state, but is supported entirely from funds left by the founder.

The city Garden comprises 75 acres, where about 12,000 species of plants are growing. There is now in process of development a tract of land of over 1,500 acres outside the city limits which is to be devoted to (1) the propagation and growing of plants, trees, and shrubs, designed for showing either indoors or outside, at the city Garden, thus avoiding the existing difficulties of growing plants in the city atmosphere; (2) gradually establishing an arboretum as well as holding a certain area as a forest reservation, with the idea that possibly at some future time this may become the new botanical garden.

The Garden is open to the public every day in the year, except New Year's Day and Christmas—week days from 8:00 a. m. until one-half hour after sunset; Sundays from 10 a. m. until sunset.

The main entrance to the Garden is located at Tower Grove Avenue and Flora Place, on the Sarah car line (No. 42). Transfer south from all intersecting lines. The Garden may also be reached by Bus Route No. 12, to which all other motor-bus lines transfer.

STAFF
OF THE MISSOURI BOTANICAL GARDEN

THE GARDEN, 2315 TOWER GROVE AVENUE, ST. LOUIS, MISSOURI

GEORGE T. MOORE,
Director

KATHERINE H. LEIGH,
Assistant to the Director

HERMANN VON SCHRENK,
Pathologist

JESSE M. GREENMAN,
Curator of Herbarium

ERNEST S. REYNOLDS,
Physiologist

CARROLL W. DODGE,
Mycologist

ROLAND V. LAGARDE,
Research Assistant

ROBERT E. WOODSON, JR.,
Research Assistant

NELL C. HORNER,
Librarian and Editor of Publications

GEORGE H. PRING,
Superintendent

JOHN NOYES,
Consulting Landscape Architect

WILLIAM F. LANGAN,
Chief Engineer

JOSEPH LANGEN,
Assistant Engineer

ARTHUR D. FORRESTER,
Plant Recorder

ALBERT PEARSON,
Painter

PAUL A. KOHL,
Floriculturist

JOHN H. KELLOGG,
Plant Collector

AUGUST P. BEILMANN,
Arboriculturist

JOSEPH CUTAK,
In charge of Exotics

LADISLAUS CUTAK,
In charge of Succulents

THE ARBORETUM, GRAY SUMMIT, MISSOURI

LARS P. JENSEN,
Manager

GUSTAVE GOEDEKE,
Foreman

DAVID MILLER,
Orchid Grower

ROY E. KISSECK,
Engineer

TROPICAL STATION, BALBOA, CANAL ZONE

A. A. HUNTER,
Manager

REPRESENTATIVE IN EUROPE

GURNEY WILSON, F. L. S.
Hove, Sussex, England

MISSOURI BOTANICAL GARDEN BULLETIN

Vol. XXI MAY, 1933 No. 5

CONTENTS

	Page
Cacti and Their Culture	81
New or Noteworthy Plants for St. Louis: III. Xanthoceras sorbifolia (Yellow Horn)	83
Bulbous Plants for St. Louis. II	84
Native Plants in Flower at the Missouri Botanical Garden Arboretum, Gray Summit, Mo., May 10, 1933	91
Notes	92
Statistical Information	94

ST. LOUIS, MO.
1933

Published Monthly, Except July and August, by the Board of Trustees

SUBSCRIPTION PRICE:

ONE DOLLAR PER YEAR SINGLE COPIES TEN CENTS

BOARD OF TRUSTEES
OF THE MISSOURI BOTANICAL GARDEN

THE ORIGINAL MEMBERS WERE DESIGNATED IN MR. SHAW'S WILL
AND THE BOARD SO CONSTITUTED, EXCLUSIVE OF THE
EX-OFFICIO MEMBERS, IS SELF-PERPETUATING

President
GEORGE C. HITCHCOCK

Vice-President
SAMUEL C. DAVIS

Second Vice-President
DANIEL K. CATLIN

L. RAY CARTER

ALBERT T. PERKINS

THOMAS S. MAFFITT

EUGENE PETTUS

GEORGE T. MOORE

ETHAN A. H. SHEPLEY

FRED G. ZEIBIG

***EX-OFFICIO* MEMBERS**

GEORGE R. THROOP,
Chancellor of Washington University

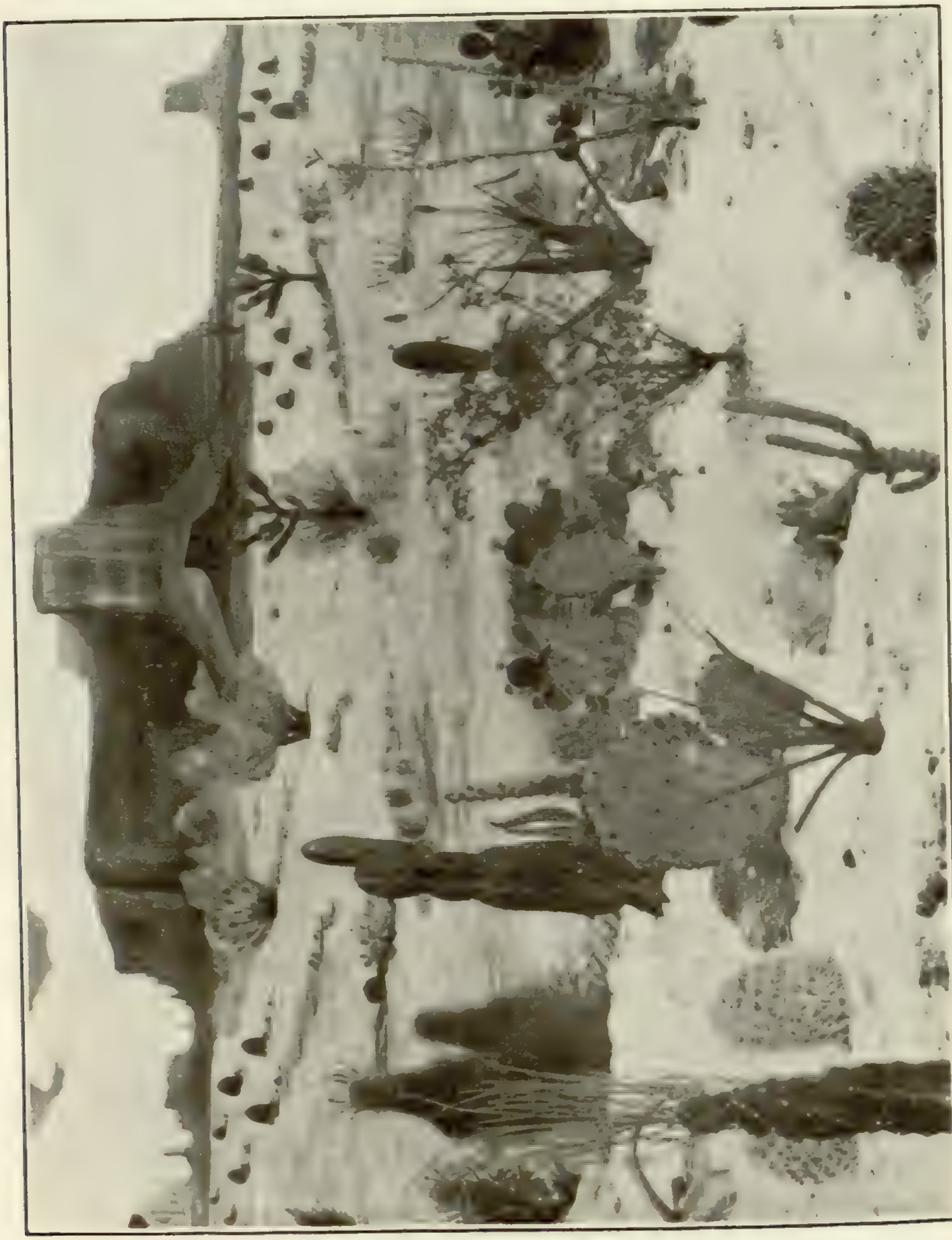
BERNARD F. DICKMANN,
Mayor of the City of St. Louis

FREDERICK F. JOHNSON,
Bishop of the Diocese of Missouri

ALBERT KUNTZ,
President of The Academy of Science of St. Louis

DAVID C. TODD
President of the Board of Education of St. Louis

Secretary
GEORGE F. HEFFERNAN



MINIATURE DESERT SCENE DISPLAYED AT THE GARDEN

Missouri Botanical
Garden Bulletin

Vol. XXI MAY, 1933 No. 5

CACTI AND THEIR CULTURE

This article is written with the hope that it may be of use to cacti enthusiasts who have had no opportunity of acquiring sufficient knowledge of the habits and treatment of these plants to grow them successfully.

Most cacti are indigenous to the warm, semi-arid regions of the Western Hemisphere (pl. 16), and in order to thrive they must be grown under the conditions of their native habitats. They flourish where few other plants can exist. The fact that they present a good appearance at all seasons of the year and that they need a minimum of care make them ideal house plants (pl. 17).

Epiphyllum, Rhipsalis, Zygocactus and some forms of trailing or climbing Cereus grow in association with the orchid, high upon the trunks and lower branches of trees in Central and South America, and naturally they will require moist surroundings for successful culture. A rich porous soil, composed of two parts of loam to one part of sand with a mixture of leaf mold, is a good potting medium. All other cacti delight in a soil consisting of equal parts of fibrous loam and sand. The addition of a dash of lime rubble, secured from some wrecked brick building, is extremely beneficial because of the organic matter contained.

Cacti may be propagated from seed, by division of large clumps, by cuttings, and by grafting. Many enthusiasts find seed the most economical way of securing a collection of these bizarre forms of vegetation. (See February, 1933,

number of the BULLETIN.) Almost all cacti may be readily propagated from cuttings. In making cuttings choose the active growing parts of the plants, and use a clean, sharp knife. Place cuttings in a dry atmosphere until a callus has been formed. Clean sand is the best rooting medium.

Often, plants collected in their native haunts are received at their destinations with roots more or less injured. When this happens the roots should be cut off close to the living tissue with a sharp knife and the plants placed in sand where they will produce a vigorous root system. Mature plants, especially of Echinocereus, are usually received with damaged roots. After cutting off the hard dry woody bottom let the wound callus thoroughly before placing the plant in sand for rooting.

In planting cacti use a pot a little larger than the body of the plant. A small quantity of gravel or broken pottery should be placed in the bottom of the container to insure perfect drainage. This is essential. Firm the soil around the roots and do not water for a few days, because the roots have to grow and adjust themselves before they can absorb the moisture. Old and large plants may be transplanted successfully, provided the root system is not disturbed and water is supplied immediately.

Most cactus plants are composed largely of soft water-laden tissue. For that reason they should be handled with care, as a cut or bruise presents a most favorable point for infection, from which rot spreads rapidly and destroys the plants.

As to watering, one authority claims cacti will stand nearly as frequent watering as a geranium, provided there is good drainage. During their active season, cacti may be watered daily and they respond marvelously to frequent sprinklings with the syringe. Do not water on cloudy days. Observe the growing center of the plant and note the differences in its condition due to an excess or deficiency of water. For success in growing plants light and air are as essential as water, and cacti grow luxuriantly when they receive abundant light and a good circulation of air. Do not keep plants in the dark if you expect blossoms to form.

CACTI IN THE HOME

TERMINAL RACEMES OF WHITE FLOWERS OF XANTHOCERAS SORBIFOLIA

NEW SHOOTS OF XANTHOCERAS, FOUR WEEKS AFTER CUTTINGS WERE MADE

Most cacti do best if given a rest for a few months. During that period, gradually decrease the amount of water until in winter it is discontinued entirely, and keep the plants in a cool and dry atmosphere. If plants are kept growing throughout the entire year there is very little chance for them to bloom. The flowering of many varieties is mainly a question of necessary rest in winter.

L. C.

NEW OR NOTEWORTHY PLANTS FOR ST. LOUIS. III.

XANTHOCERAS SORBIFOLIA (YELLOW HORN)

During seasons of normal rainfall trees and shrubs with large flowers and luxuriant foliage are not outstanding. However, after successive years of drought if a plant is still luxuriant, that individual forces itself on our attention. Most shrubs suffered severely in 1931 and 1932, but in both years *Xanthoceras sorbifolia* developed normally (pl. 18, fig. 1) and produced large clusters of flowers. This plant, a close relative of the Chinese varnish tree, comes from northern China, and seems well adapted to dry situations. The flowers are white with a yellow spot changing to red at the base of each petal, are over an inch in diameter, and borne in racemes 6-10 inches long. The leaves are from 6 to 12 inches long, with many opposite leaflets. The plant attains a height of 15 feet with a spread almost as great, and is equally effective whether used in a border or as an individual specimen. It has a pleasing, though somewhat loose, growth habit, and requires very little pruning.

The fact that the plant is not easily propagated accounts for its rarity in gardens. The seeds resemble small black buckeyes, but seldom germinate. Neither hardwood nor softwood cuttings root with regularity, but fortunately root cuttings root easily. If pieces 3 or 4 inches long of the heavier roots are placed in a propagating frame (pl. 18, fig. 2) in early spring, within four weeks new shoots will appear and shortly after new roots will be formed (pl. 19, fig. 1). The cuttings should then be potted and placed in a

warm house until later in spring, when they may be planted in a cold-frame or the nursery, or the individual root cuttings may be placed directly in a six- or eight-inch pot (pl. 19, fig. 2) and left there for an entire year. Since Xanthoceras does not stand transplanting very well, a single cutting should be planted in a pot. Very little growth will be made the first year unless good soil and sufficient water is supplied.

A. P. B.

BULBOUS PLANTS FOR ST. LOUIS. II.

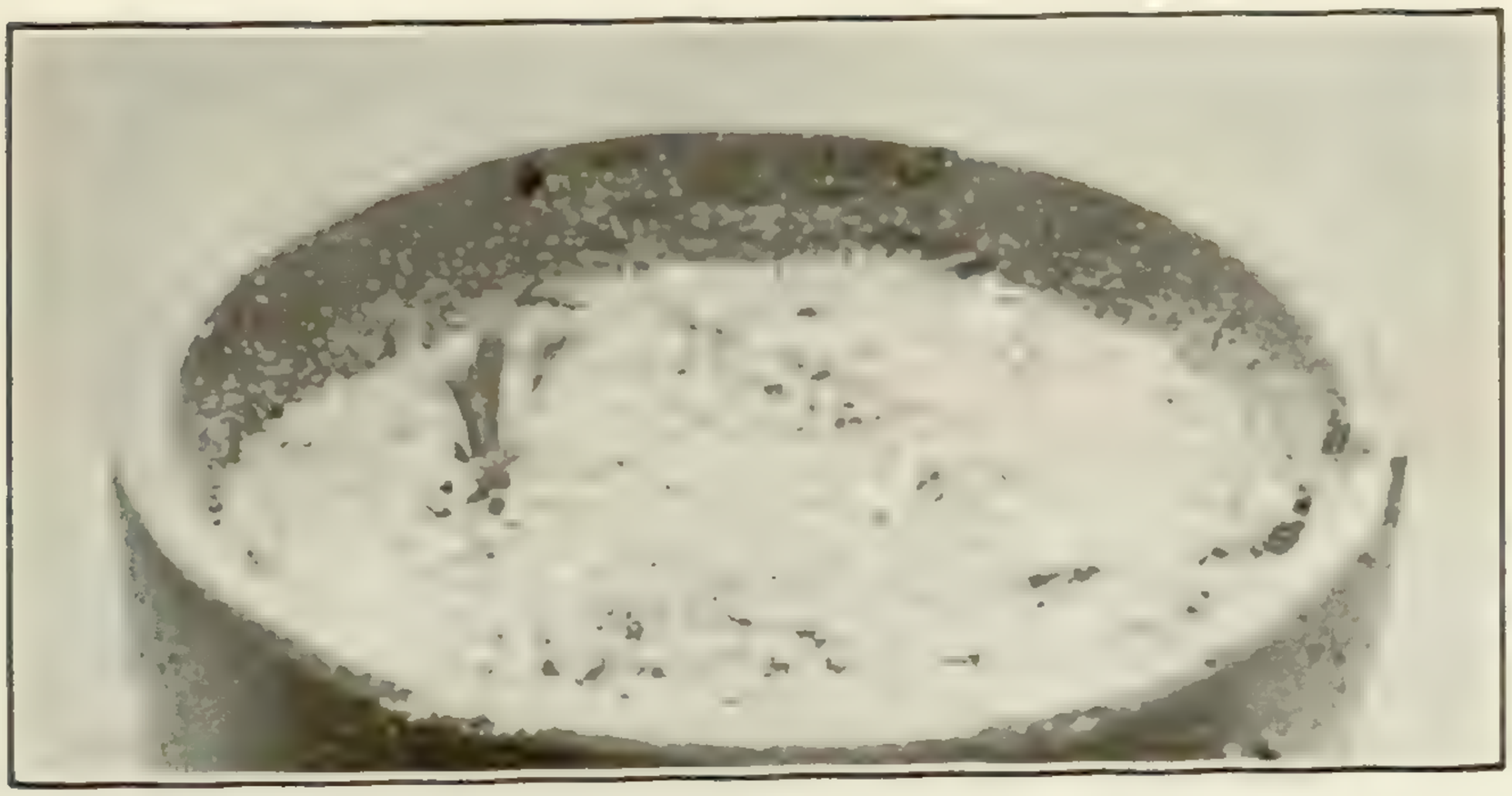
In the October, 1932, number of the BULLETIN, Mr. A. G. Ulrich gave an account of his experiences in growing some bulbous plants in St. Louis. Following are descriptions by Mr. Ulrich of some additional plants which he has succeeded in growing:

"*Amaryllis Belladonna* (belladonna lily).—Family Amaryllidaceae. This amaryllis is a native of the Cape of Good Hope, where conditions are just the opposite to ours. It succeeds best if grown in a cold-frame in full sun. In mild localities it can be grown at the base of a south wall in deeply worked rich soil, provided the bulbs are well protected in cold weather. A vigorous and undisturbed growth of leaf is absolutely essential to bring this bulb into flower. One great difficulty in our climate is that fall rains induce leaf growth and later the leaves are damaged by a freeze. The writer has tried growing it in pots but with no degree of success. The flower scape appears in September before the leaves. It is fragrant, of a delicate silvery rose color, and grows in clusters on a leafless stem.

"Var. *blanda*.—Larger bulbs. Umbels of white flowers turning to pale rose. Most of the other varieties are not obtainable in full growth.

"*Camassia* (quamash, or camass, the Indian name).—Family Liliaceae. A genus of handsome bulbous plants found only in North America in temperate regions, in rich meadows which are wet in winter and spring and dry in summer. The bulbs are perfectly hardy and should be

ROOTED CUTTING OF XANTHOCERAS, EIGHT WEEKS OLD



METHOD OF PLACING A SINGLE CUTTING IN A POT

planted in early fall. The plants may be raised from seed, but it is three or four years before they come into bloom. The flowers are blue or white and resemble Scillas.

"*C. Cusickii.*—One of the best of the Camassias. Bulbs large. Flowers pale delicate blue, from 30 to 100 being borne on a scape.

"*C. esculenta.*—Flowers dark blue or purple, 10 to 40 on a scape. These bulbs are eaten by the Indians.

"*C. Fraseri.*—Bulbs rather small. Flowers pale blue. Our native Camassia is easily transplanted to our gardens and makes a wonderful display when planted in large clumps.

"*Chlidanthus fragrans.* — Family Amaryllidaceae. Habitat: Andes of Peru. These bulbs increase so rapidly by splitting and offsets that it is difficult to keep them of a size to flower. Their constitution is very much like that of the tender narcissus. They should be planted in a fertile loam and cultivated during the summer. At the approach of winter they should be taken up without disturbing the roots, placed in dry sandy soil, and kept in a dry situation at a temperature of about 60° F. About April, when they begin to grow, remove all offsets and plant in the open ground. They grow vigorously and flower in June or July. The flowers are yellow and very fragrant. This bulb is offered by California dealers.

"*Fritillaria.*—From the Latin *fritillus,* meaning checker board or dice box. Family Liliaceae. The American species are very beautiful but not so well adapted to our soil and climatic conditions as the following:

"*F. Imperialis* (crown imperial). — A native of Persia. The flowers bloom at the end of March. They are the largest of any of those in the genus, and are borne in whorls of 8 to 10. There are single and double forms in yellow and red, some with striped foliage, and the Dutch dealers advertise other colors. The bulbs should be planted in the early fall in a location shaded from the midday sun. They require deep planting, rich soil, and considerable room. Rotted manure may be worked in the soil 5 or 6 inches below the bulb.

"*F. meleagris* (snake's head, checkered lily).—A native of England, Norway, and Central Europe. There are numerous varieties all blooming in early summer. They have a solitary graceful drooping flower tesselated with purple and maroon on a pale ground. They bloom profusely and tufts of the checkered or white-flowered variety are among the most effective border plants. The bulbs should be planted in a sandy soil about 2-3 inches deep. They multiply rapidly under proper conditions.

"*Hippeastrum* (Amaryllis.) — Family Amaryllidaceae. The common garden name of Amaryllis is used by most persons to designate this bulb. However, there is only one species of the genus Amaryllis, and that is *Amaryllis Belladonna.* The difference between the two genera is that the Amaryllis is entirely deciduous, producing the flowers before the leaves, and the true Hippeastrum is evergreen. In the crossing of species the Hippeastrum has in many cases become as leafless as the Amaryllis, and it is rather difficult to know which varieties to dry off and which to keep evergreen. *Hippeastrum aulicum,* which is evergreen, has been used in hybridizing, and naturally hybrids of this species have a tendency to remain evergreen. *Hippeastrum vittatum,* which in its native habitat is deciduous, has been widely used in hybridizing, and its hybrids need to be dried off in their resting period. Any variety that has a tendency to remain evergreen should be given water sparingly during its resting period, just enough to keep the leaves from flagging.

"The culture of these interesting and beautiful plants is simple if their requirements are understood. Use a small pot; if they are pot-bound the plants are almost sure to bloom. If obtainable use charcoal to cover the drainage hole; otherwise use bits of broken pots. Good drainage is essential to the health of this bulb. Do not disturb the roots any more than is necessary. In repotting use one size larger pot and a compost of sod soil, a portion of sand, and rotted cow manure. The potted plants should be plunged in a semi-shaded place in the ground. The leaves are formed in the spring and continue to grow more or less throughout the summer, and it is absolutely necessary that the growth be as thriving

as possible in order to obtain flowers the next spring. In the fall the plants should be taken indoors and rested. Early in the spring (if the summer's growth has been good) the flower bud appears, sometimes before the leaves and sometimes with the leaves.

"All Amaryllis should receive a fair amount of water during their growing period. Be careful to apply the water directly to the soil, for a disease called red rust, easily recognized by red streaks and spots on the leaves, is often caused by wetting the center of the leaves. Toward fall, when growth has been completed, less water should be given. After the leaves have turned yellow the bulbs should be stored in a dry place at a temperature of about 50° F., care being taken not to disturb the roots. This applies to varieties that have a tendency to dry off. In large collections thrips and mealy bugs sometimes prove troublesome. Spraying with a tobacco solution (black leaf 40) or fumigating will control thrips. Mealy bugs are rather hard to exterminate, but a solution of equal parts of water and denatured alcohol, applied with a long-handle brush directly on the pests, seems to be about as effective a remedy as anything. They have a way of protecting themselves with a cottony web, and spraying with tobacco has no effect except in the early stages. Liquid manure about every two weeks is beneficial to growth.

"*H. aulicum* (lily-of-the-palace).—A very handsome plant of Brazil introduced into cultivation in 1819. Scape 1-1½ feet high bearing two large crimson flowers with segments green at the base. This species and its varieties are evergreen and must never be dried off in winter. The vigor of the flower has been transmitted to the hybrids. Some of the early hybrids, such as *H. Ackermanni,* have the potentiality and constitution of a species and have had an immense influence on the hybrids of the present day.

"Var. *glaucophyllum.*—Leaves glaucous. Flower with a very large green star. Found in the Organ Mountains in Brazil.

"Var. *platypetalum.* — Petals wider than those in the species, with a large green star at the base.

"*H. equestre* (Barbados lily). — A native of tropical America, West Indies, Mexico, Chile, and Brazil, introduced into cultivation about 1700. It possesses a fine flower of medium size, crimson or scarlet with a green star. The plant is of singular constitution and is frequently lost. It will not live if constantly watered from the top; instead set the pot in a pan of water until the soil is moist. A mixture of loam, peat, and sand is a good growing medium. Keep the bulb in a cool situation during the winter. In Florida this species has found a second home, where it grows luxuriantly in sandy soil. It is sometimes offered by bulb growers under the name of *H. Reginae,* which is an entirely different species. There is also a form with semi-double flowers that has the same poor constitution as the single flowering kind.

"Var. *major*. — Flower larger, strikingly resembling that of some of the modern hybrids. Instead of a green star it has a white center.

"*H. rutilum*.—This species was introduced into cultivation about the year 1810. Its original habitat is central Brazil where it branches into a vast number of varieties, some having been recognized as separate species. However, they all agree in producing blind offsets around the bulb, some of which have been known to lie dormant for years. The flower is orange-colored, of various tints, with the upper petal more or less recurved and the cernuous tube smooth or only slightly bearded at the mouth. The species is more generally grown than any of the varieties. It is often seen in communities where it has been disseminated from one family to another. My supply was obtained that way.

"This bulb is of easy culture. It must be kept growing during spring and early summer and the supply of water gradually diminished toward fall. Do not dry off completely but give just enough moisture to keep the leaves evergreen. It often flowers in early winter and early summer. It should be wintered in a moderately cool situation. Pot in a mixture of loam, leaf mold, and sand, with a small quantity of cow manure.

"*Hymenocallis occidentalis* (Missouri spider lily.) — Family Amaryllidaceae. This is the only hardy spider lily

and is found in southern Missouri, southern Illinois, and Kentucky. I have gathered the plants in Kentucky growing in creek bottoms. In Missouri they grow on higher ground and seem to be plentiful in Butler County. Three to six white flowers are borne on a scape 18-20 inches high. The seeds are fleshy, bulbous-like, usually 2 in a cell.

"*H. galvestonensis* is a closely allied species found in Texas and Louisiana. It is claimed to be hardy, but I have never grown it in my garden successfully.

"*Pancratium* (spider or spirit lily).—From *pan,* all, and *kratyo,* powerful, referring to the supposed medicinal value. Family Amaryllidaceae. Pancratium and Hymenocallis somewhat resemble each other, but the former is an Old World genus, while the latter belongs to the New World.

"*P. illyricum.*—A native of southern Europe and the only hardy species of the genus. The scape is 1-2 feet high and bears 6-12 flowers in an umbel. They bloom in summer and are very fragrant. The plant thrives in a warm sandy loam soil, but should be slightly protected in winter. Large bulbs often have 2 or 3 flowering scapes. This is a very dependable and satisfactory blooming species.

"*P. maritimum.* — This species is a native of southern Europe. It is hardy in mild climates or in protected situations. It has succeeded fairly well in my garden where it is planted at the foot of a south wall and protected in winter. The flowers are borne 5-10 in an umbel and are very fragrant.

"*P. zeylanicum, Sickenbergeri,* and *canariense* are of rather difficult culture and not recommended for our conditions.

"*Triteleia uniflora* (spring star flower).—Family Liliaceae. Native of the Andes of Argentina. It is a grass-leaved bulbous plant, and hardy although short-lived. The flowers are 4-6 inches high, white with blush reflections, marked on the outside through the middle with a violet streak. They open at sunrise and close on dull days. They bloom profusely in pots, and can also be used in rock gardens or borders.

"*Zephyranthes* (zephyr lily, fairy lily).—From *zephyr* meaning wind, and *anthos,* flower. Family Amaryllidaceae.

The most popular species of Zephyranthes are *Z. carinata* and *Z. candida.* The latter is a native of the marshes of the La Plata River, and the name of the river (meaning silver) is said to have been given because of the abundance of white flowers growing on the shore. The leaves and flowers are produced in profusion in autumn. In this climate the plant may prove hardy if planted against a south wall and protected. I prefer to plant it in pots. It must never be allowed to dry off.

"*Z. Atamasco.*—A native of southern United States. It is the largest of the white spring-flowering species and very popular. Store the bulbs during the winter at a temperature of about 40-50° F. Do not dry them off but give a fair amount of water to keep them plump.

"*Z. Treatiae.*—Closely allied to the above species. The flowers of both turn pinkish with age but those of *Z. Treatiae* bloom later and the segments are sometimes keeled with rose. In Florida, the cattlemen burn off the lowlands to induce a new growth of grass for the cattle. Since Zephyranthes then appear like magic on the burnt-over land, they are called fire lilies by the natives.

"*Z. rosea.*—A native of Cuba, bearing small rose-colored flowers which bloom in autumn. It is of easy culture but difficult to obtain and does not multiply so rapidly as other species.

"*Z. texana.*—A native of Texas and part of Louisiana, but hard to locate in its natural habitat because it grows among the grass. The flowers are yellow, copper-colored on the outside.

"There are other species of Zephyranthes that are worth growing but not easily obtainable, such as *erubescens, verecunda, Lindleyana, longifolia,* and *citrina.* I have some interesting hybrids that are doing well. With the exception of *Z. carinata,* I have had more success growing the bulbs in pots. A sandy sod soil with some leaf mould and rotted cow manure is a good potting medium."

NATIVE PLANTS IN FLOWER AT THE MISSOURI BOTANICAL GARDEN ARBORETUM, GRAY SUMMIT, MO., MAY 10, 1933

1. *Anemonella thalictroides* (Rue anemone)
2. *Antennaria plantaginifolia* (Early everlasting, Pussy's toes)
3. *Aquilegia canadensis* (Wild columbine)
4. *Arabis virginicia* (Rock cress)
5. *Arabis dentata* (Rock cress)
6. *Arabis laevigata* (Rock cress)
7. *Arenaria patula* (Sandwort)
8. *Arisaema triphyllum* (Jack-in-the-pulpit)
9. *Asarum canadense* (Wild ginger)
10. *Asimina triloba* (Papaw)
11. *Astragalus distortus* (Purple vetch)
12. *Astragalus mexicanus* (Ground plum)
13. *Barbarea vulgaris* (Yellow rocket, common winter cress)
14. *Camassia esculenta* (Wild hyacinth)
15. *Capsella Bursa-pastoris* (Shepherd's purse)
16. *Cerastium nutans* (Chickwood)
17. *Claytonia virginica* (Spring beauty)
18. *Comandra umbellata* (Bastard toad-flax)
19. *Cornus florida* (Flowering dogwood)
20. *Corydalis aurea* (Golden corydalis)
21. *Delphinium tricorne* (Short larkspur)
22. *Dodecatheon Meadia* (Shooting star)
23. *Erigeron canadensis* (Canada fleabane)
24. *Erigeron pulchellus* (Early fleabane)
25. *Euphorbia commutata* (Green spurge)
26. *Fragaria virginiana* (Wild strawberry)
27. *Geranium maculatum* (Wild cranesbill)
28. *Heuchera hirsuticaulis* (Alum root)
29. *Houstonia purpurea* (Houstonia)
30. *Hybanthus concolor* (Green violet)
31. *Hydrophyllum appendiculatum* (Water-leaf)
32. *Hypoxis hirsuta* (Yellow star grass)
33. *Leavenworthia uniflora* (Leavenworthia)
34. *Lepidium virginicum* (Pepper-grass)
35. *Lithospermum canescens* (Hoary puccoon)
36. *Myosurus minimus* (Mouse-tail)
37. *Nothoscordum bivalve* (False yellow garlic)
38. *Oxalis stricta* (Sheep sorrel)
39. *Oxalis violacea* (Violet wood sorrel)
40. *Pentstemon hirsutus* (Hairy beard-tongue)
41. *Phacelia Purshii* (Pursh's phacelia)
42. *Phlox divaricata* (Blue phlox)
43. *Physocarpus opulifolius* (Ninebark)
44. *Plantago lanceolata* (Lance-leaved plantain)
45. *Podophyllum peltatum* (May apple)

46. *Polemonium reptans* (Greek valerian, Jacob's ladder)
47. *Polygonatum biflorum* (Solomon's seal)
48. *Potentilla canadensis* (Five-finger)
49. *Prunus virginiana* (Choke cherry)
50. *Pyrus ioensis* (Crab apple)
51. *Ranunculus abortivus* (Small-flowered buttercup)
52. *Ranunculus recurvatus* (Hooked buttercup)
53. *Ranunculus septentrionalis* (Swamp buttercup)
54. *Rubus villosus* (Dewberry)
55. *Rumex Acetosella* (Sheep sorrel)
56. *Senecio aureus* (Squaw-weed)
57. *Senecio plattensis* (Prairie ragwort)
58. *Sisymbrium canescens* (Hedge mustard)
59. *Sisyrinchium albidum* (Blue-eyed grass)
60. *Smilacina racemosa* (False Solomon's seal)
61. *Staphylea trifolia* (Bladder nut)
62. *Taraxacum officinale* (Dandelion)
63. *Trifolium repens* (White clover)
64. *Triosteum perfoliatum* (Horse gentian)
65. *Trillium recurvatum* (Wake robin)
66. *Trillium sessile* (Wake robin)
67. *Uvularia grandiflora* (Bellwort)
68. *Valerianella radiata* (Corn salad)
69. *Viburnum rufidulum* (Black haw)
70. *Viola cucullata* (Blue violet)
71. *Viola pedata* (Bird's-foot violet)
72. *Viola pedata* var. *bicolor* (Two-colored bird's-foot violet)
73. *Viola pubescens* (Downy yellow violet)
74. *Viola Rafinesquii* (Wild pansy)
75. *Viola striata* (White violet)
76. *Zizia aurea* (Golden Alexanders)

NOTES

The fifth annual spring flower show of the St. Louis Horticultural Society was held in the floral display house at the Garden, May 19-21.

Prof. H. W. Rickett, associate professor of botany, University of Missouri, accompanied by his class in taxonomy, visited the Garden, library, and herbarium, May 20.

The annual flower sermon, provided for in the will of Henry Shaw, was preached at Christ Church Cathedral, April 30, by Dr. George T. Moore, Director of the Garden.

Dr. J. M. Greenman, Curator of the Herbarium, gave a paper before the Illinois Academy of Science, in East St. Louis, May 5, on "The Baptisias of the Mississippi Valley."

Mr. Paul A. Kohl, Floriculturist to the Garden, gave an illustrated talk at the Village Trading Post before the Child Conservation Conference, April 27, on "The Planting of Seeds."

At a meeting of the Garden Club of St. Louis, May 16, Mr. A. P. Beilmann, Arboriculturist to the Garden, gave an illustrated talk on "The Care of Trees — Pruning and Fertilization."

Dr. George T. Moore, Director of the Garden, served as one of the judges at the fifth national orchid exhibition of the American Orchid Society, at Longwood, Kennett Square, Pennsylvania, May 5.

Recent visitors to the Garden include Mr. Nils N. Emitslöf, of Christianstad, Sweden; Dr. George H. Smith, of Indianapolis, Indiana; Dr. H. S. Pepoon, of the Illinois State Natural History Survey; and Prof. A. C. Noe, associate professor of palaeobotany, University of Chicago.

Mr. L. P. Jensen, Manager Missouri Botanical Garden Arboretum, Gray Summit, gave a talk before the P. E. O. of Washington, Mo., May 1, on "Your Garden and Mine"; and before the members of the Garden Club of Gray Summit, at the Arboretum, May 7, on "New and Better Shrubs for Your Garden."

Mr. George H. Pring, Superintendent of the Garden, has given the following talks recently: April 26, before the students of Hosmer Hall, "Spring Flowers"; April 26, before the Rotary Club of Clayton, "Plant Exploration"; April 28, at the Village Trading Post before the Child Conservation Conference, "Spring Planting in the Garden"; May 2, before the Highland Woman's Club, Highland, Ill., "Water-lilies"; May 5, before the St. Louis Horticultural Society, "What to Plant in the Garden"; May 8, before the St. Clair Garden Club, East St. Louis, Ill., "City Gardens"; May 11, before the Adolphus Busch School Parent-Teacher Association, "How to Plant a City Garden"; May 13, before the Home Economics and Arts Club, "New or Noteworthy Plants."

STATISTICAL INFORMATION FOR APRIL, 1933

GARDEN ATTENDANCE:

Total number of visitors.....23,679

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought.....	28
Total number of books and pamphlets donated.....	246

PLANT ACCESSIONS:

Total number of plants and seed packets donated.....	1,422

HERBARIUM ACCESSIONS:

By Purchase—

Broadway, W. E.—Plants of Trinidad, British West Indies	53
Elmer, A. D. E.—Plants of the Philippine Islands.....	423
Herter, Dr. Guillermo—Plants of Uruguay.....	132
Lawrance, Alexander E.—Plants of Colombia.....	995
Lingnan University, by Professor F. A. McClure—Plants of China.....	559

By Gift—

Barkley, Mrs. Fred A.—Plants of Oklahoma.....	33
Harrison, Professor Bertrand—Plants of Utah.....	106
Larsen, Mr. E. C.—*Limosella aquatica L.* from Utah...	1
Steyermark, Julian A.—Plants of eastern United States collected by H. W. Edmonds.....	349

By Exchange—

Demaree, Professor Delzie—Plants of Florida.....	79
New York Botanical Garden—Plants of China.....	2
University of Michigan—Mosses and hepatics from Sumatra	21
University of Wisconsin Herbarium by Dr. J. J. Davis, "Fungi Wisconsinenses Exsiccati," Decades XVI and XVII, Nos. 151-170 inclusive.....	20
Total	2773

SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date to the death of Mr. Shaw, in 1889, the Garden was maintained under the personal direction of its founder, and, while virtually a private garden, it was, except at certain stated times, always open to the public. Although popularly known as "Shaw's Garden" the name Missouri Botanical Garden was designated by Mr. Shaw as its official title and in his will or in any of his writings he specifically referred to it as the "Missouri Botanical Garden." By a provision of Mr. Shaw's will the Garden passed at his death into the hands of a Board of Trustees. The original members of the Board were designated in the will, and the Board so constituted, exclusive of certain ex-officio members, is self-perpetuating. By a further provision of the will, the immediate direction of the Garden is vested in a Director, appointed by the Board of Trustees. The Garden receives no income from city or state, but is supported entirely from funds left by the founder.

The city Garden comprises 75 acres, where about 12,000 species of plants are growing. There is now in process of development a tract of land of over 1,500 acres outside the city limits which is to be devoted to (1) the propagation and growing of plants, trees, and shrubs, designed for showing either indoors or outside, at the city Garden, thus avoiding the existing difficulties of growing plants in the city atmosphere; (2) gradually establishing an arboretum as well as holding a certain area as a forest reservation, with the idea that possibly at some future time this may become the new botanical garden.

The Garden is open to the public every day in the year, except New Year's Day and Christmas—week days from 8:00 a. m. until one-half hour after sunset; Sundays from 10 a. m. until sunset.

The main entrance to the Garden is located at Tower Grove Avenue and Flora Place, on the Sarah car line (No. 42). Transfer south from all intersecting lines. The Garden may also be reached by Bus Route No. 12, to which all other motor-bus lines transfer.

STAFF
OF THE MISSOURI BOTANICAL GARDEN

THE GARDEN, 2315 TOWER GROVE AVENUE, ST. LOUIS, MISSOURI

GEORGE T. MOORE,
Director

KATHERINE H. LEIGH,
Assistant to the Director

HERMANN VON SCHRENK,
Pathologist

CARROLL W. DODGE,
Mycologist

JESSE M. GREENMAN,
Curator of Herbarium

ROLAND V. LAGARDE,
Research Assistant

ERNEST S. REYNOLDS,
Physiologist

ROBERT E. WOODSON, JR.,
Research Assistant

NELL C. HORNER,
Librarian and Editor of Publications

GEORGE H. PRING,
Superintendent

JOHN NOYES,
Consulting Landscape Architect

PAUL A. KOHL,
Floriculturist

WILLIAM F. LANGAN,
Chief Engineer

JOHN H. KELLOGG,
Plant Collector

JOSEPH LANGEN,
Assistant Engineer

AUGUST P. BEILMANN,
Arboriculturist

ARTHUR D. FORRESTER,
Plant Recorder

JOSEPH CUTAK,
In charge of Exotics

ALBERT PEARSON,
Painter

LADISLAUS CUTAK,
In charge of Succulents

THE ARBORETUM, GRAY SUMMIT, MISSOURI

LARS P. JENSEN,
Manager

GUSTAVE GOEDEKE,
Foreman

DAVID MILLER,
Orchid Grower

ROY E. KISSECK,
Engineer

TROPICAL STATION, BALBOA, CANAL ZONE

A. A. HUNTER,
Manager

REPRESENTATIVE IN EUROPE

GURNEY WILSON, F. L. S.
Hove, Sussex, England

MISSOURI BOTANICAL GARDEN BULLETIN

Vol. XXI JUNE, 1933 No. 6

CONTENTS

	Page
Ceropegias	95
Curious Orchids in the Garden Collection	96
The Killdeer	99
Notes	101
Statistical Information	102

ST. LOUIS, MO.
1933

Published Monthly, Except July and August, by the Board of Trustees

SUBSCRIPTION PRICE:

ONE DOLLAR PER YEAR SINGLE COPIES TEN CENTS

BOARD OF TRUSTEES
OF THE MISSOURI BOTANICAL GARDEN

THE ORIGINAL MEMBERS WERE DESIGNATED IN MR. SHAW'S WILL
AND THE BOARD SO CONSTITUTED, EXCLUSIVE OF THE
EX-OFFICIO MEMBERS, IS SELF-PERPETUATING

President
GEORGE C. HITCHCOCK

Vice-President
SAMUEL C. DAVIS

Second Vice-President
DANIEL K. CATLIN

L. RAY CARTER — ALBERT T. PERKINS

THOMAS S. MAFFITT — EUGENE PETTUS

GEORGE T. MOORE — ETHAN A. H. SHEPLEY

FRED G. ZEIBIG

EX-OFFICIO MEMBERS

GEORGE R. THROOP,
Chancellor of Washington University

BERNARD F. DICKMANN,
Mayor of the City of St. Louis

FREDERICK F. JOHNSON,
Bishop of the Diocese of Missouri

ALBERT KUNTZ,
President of The Academy of Science of St. Louis

DAVID C. TODD
President of the Board of Education of St. Louis

Secretary
GEORGE F. HEFFERNAN

CIRRHOPETALUM MEDUSAE

Missouri Botanical Garden Bulletin

Vol. XXI JUNE, 1933 No. 6

CEROPEGIAS

Ceropegia is a genus of peculiar, usually twining plants, native of the East Indies and South Africa. It is remarkable for its waxy flowers, frequently arranged in delicate umbels, hence the name, from two Greek words, *keros,* meaning wax, and *pege,* fountain.

Ceropegia belongs to the Asclepiads, or milkweed family, which includes such succulent genera as Caralluma, Duvalia, Huernia, Stapelia, Tavaresia, and Trichocaulon. Some species of Ceropegia have tuberous rhizomes, some very succulent leaves, while others have fleshy leafless stems. The form and waxy appearance of the flowers are perhaps the most outstanding features of the plants. The flowers of Ceropegia are a combination of two kinds of traps: a spring trap, such as in other asclepiads, and a cage trap, such as occurs in Aristolochia, constructed on the same principle as an ordinary mouse trap with inwardly pointing elastic wires. The flowers of *Ceropegia Woodii* (plate 21, fig. 1) have lobes connected at their tips, forming a cage-like crown of five longitudinal slits. Through these slits tiny insects, attracted by the scent that emanates from within, enter the flower and, slipping down the tube, finally reach the inflated base, where in an effort to escape they pollinate the flower.

Most Ceropegias are very striking plants and lend themselves well to cultivation in greenhouses and conservatories. They should be treated in the same manner as other suc-

culents; grown in a mixture of fibrous loam, sand, and leaf-mold, and in the dormant state should be watered sparingly.

Ceropegia Woodii, a native of Natal, is a very slender, and elegant plant, and the most satisfactory of the genus for culture. It is admirably adapted for hanging vases and baskets (pl. 21, fig. 2), as its numerous stems hang gracefully down and are well furnished with small, somewhat heart-shaped, fleshy, variegated leaves. The flowers are pinkish-violet, produced in the fall. The plant is easily propagated from seed and from the small, globose tubers formed in the axils on the stems. The tubers may be potted separately for propagation.

Another species which may be successfully grown in the greenhouse is *Ceropegia Sandersonii.* It is a native of Zululand and is an object of beauty and curiosity when in flower. In growth habit it resembles a vanilla plant. It has very succulent leaves but its most remarkable feature is the flower. Its broad-lobed hood of mottled-green forms sort of a parachute over the mouth of the transparent corolla, hence the popular name, parachute plant (pl. 21, fig. 3). It is said that the stem and leaves are eaten by the Kaffirs and have an agreeable flavor.

Ceropegia stapeliaeformis, a native of East Indies, is another striking and curious member of this genus. The stems are rounded, glabrous, dark green in color, marked with soft, spiniform projections, and resemble those of Stapelia, as its specific name indicates (pl. 21, fig. 4).

L. C.

CURIOUS ORCHIDS IN THE GARDEN COLLECTION

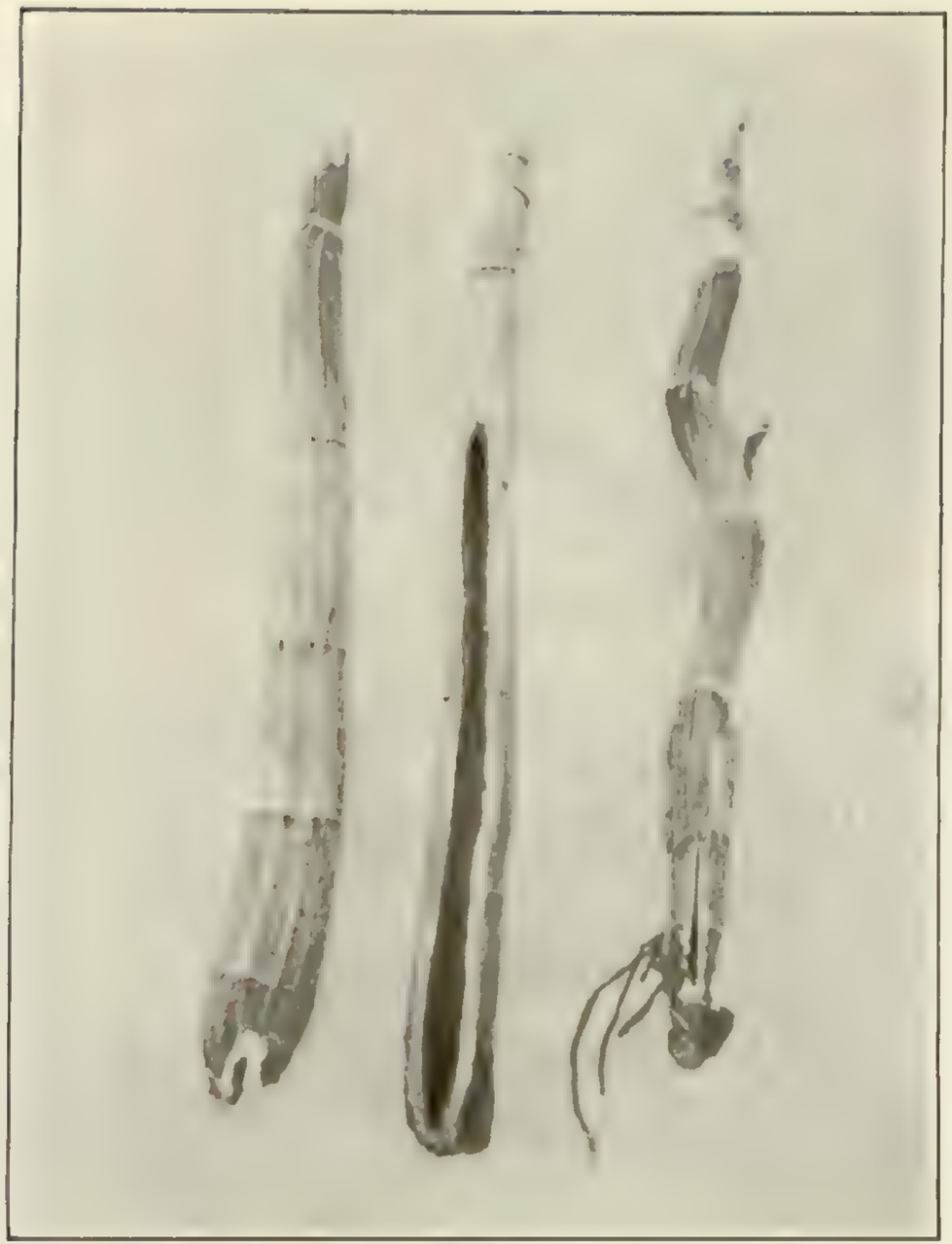
When orchids are displayed at the Garden the kinds with gorgeous flowers, such as Cattleya, Cypripedium, and Dendrobium, attract the most attention, while the plants of greatest botanical interest are often overlooked. As a rule the latter are small with inconspicuous flowers, and a hand-lens is necessary to observe minute details which frequently constitute the interesting features. In previous

FLOWERS OF CEROPEGIA WOODII

CEROPEGIA WOODII

CEROPEGIA SANDERSONII

CEROPEGIA STAPELIAEFORMIS



LEFT—PSEUDOBULB OF SCHOMBURGKIA TIBICINIS SHOWING OPENING FOR ANTS AT THE BASE; CENTER—OTHER SIDE OF PSEUDOBULB SHOWING HOLLOW WHICH THE ANTS INHABIT; RIGHT—PSEUDOBULB OF DIACRIUM BICORNUTUM SHOWING SLIT-LIKE OPENING FOR ANTS.

BULBOPHYLLUM BARBIGERUM

numbers of the BULLETIN the dove orchid, swan orchid, bucket orchid, etc., have been fully described. Some of the more curious and less showy orchids in the Garden collection are discussed here.

Bulbophyllum barbigerum (bearded lip orchid).—Native of west coast of Africa introduced into England about 1886. In this species the pseudobulbs ascend the trees spirally along a single rhizome. They are small, about half an inch in width, circular, compressed, with a single sheaf-like leaf. The flower spikes contain seven to twelve brush-like brown flowers, the sepals being oblong tapering to a point, while the petals are miniature scales. The lip is covered with long purple thread-like hairs forming a brush which is hinged to the column at its basal portion. The entire structure is so sensitive to disturbances of the atmosphere and its rocking motion so conspicuous that one gets the impression of animal agency at work or a perfect mechanical contrivance.

Bulbophyllum Dayanum (bearded orchid). — Native of East Indies. The pseudobulbs are small, pear-shaped, with a single oblong leathery leaf, dark purple below and green above. The plants grow in chains upon the trunks of trees. The purplish flowers are produced in clusters, with the three outer sepals provided with long hairs while two of the petals are fringed with a fine pubescence. The lip is tongue-shaped, grooved, with two sentinel horns which act as guides for visiting insects. It bends down with the weight of the insect and springs back as the insect nears the pollen masses, thus forcing it to come in touch with the pollinia.

Bulbophyllum Lobbii (swinging lip orchid). — An epiphyte of Java similar in growth to the bearded orchid. The flowers are yellow spotted with purple. The grooved lip is composed of two sections, the outer balanced on the inner. The lip tips when an insect lands upon it, forcing the insect toward the back of the flower. The insect is induced to travel along a continued pathway made by the groove of the lip and the bent column, and when its work is accomplished the lip springs back.

Cirrhopetalum Medusae (Medusa's-head). — Medusa's head is one of the most peculiar species of the genus. The resemblance of the flower spike to a head with long disheveled hair induced Dr. Lindley, who first described the orchid, to give the plant its name. The flowers are cream-colored spotted with purple. Their peculiar appearance is due to the two lateral sepals, which are hair-like, often reaching five to six inches in length. The pseudobulbs are pear-shaped, with a single very leathery oblong leaf.

The plant was first introduced about 1840 from Singapore by Messrs. Loddiges of England, famous orchid growers. The flowers may be seen in bloom at the Garden in the orchid alcoves during March. They are short-lived, lasting only about four to seven days.

Diacrium bicornutum.—This orchid is closely related to the genus Epidendrum, a native epiphyte of tropical America. The pseudobulbs are two feet long, hollow, cylindrical, bearing several dry sheaths. The leaves are leathery, short, oblong to lanceolate. The spikes of three to twelve flowers appear at the top of the pseudobulb. They are fragrant, white, with small crimson spots on the three-lobed lip. The specific name *bicornutum* is derived from the two horn-like appendages at the center of the lip. An opening at the base of the pseudobulb provides entrance for the stinging ants that make their home within. Diacriums are rarely seen under cultivation, but at the Missouri Botanical Garden, a plant has been thriving for the last twenty years.

Pleurothallis villosa (nodding orchid). — A very small epiphytic orchid native of tropical America. The elongated stems bear a solitary reddish leaf, at the back of which are produced the small spikes of flowers. The flowers are the same color as the leaf and are covered with minute hairs. The lip is very sensitive to the slightest movement of the atmosphere, springing up with a sudden jerk. If one bends close to the flowers the vibration from breathing causes them to move their lips and appear to nod to the observer.

BULBOPHYLLUM DAYANUM

BULBOPHYLLUM LOBBII

SCHOMBURGKIA TIBICINIS

DIACRIUM BICORNUTUM

Schomburgkia tibicinis (cow-horn orchid).—An epiphytic plant of Honduras. The tapering pseudobulb is one to one and one-half feet long and terminates in two to three leathery ovate leaves. The flowering spike is four to eight feet long, and consists of numerous flowers three and one-half inches wide with crisp undulate sepals and petals. Their color is pink speckled with white, rich red within, the lip being white and rose, chocolate-red at the middle. At the base of the pseudobulb is located an opening for the ants which inhabit the interior and apparently are necessary for the growth of the plant.

The collecting of these ant-inhabiting plants is an unforgettable experience. The author, in company with Mr. A. A. Hunter, Manager of the Garden Tropical Station, Panama, attempted to collect *Diacrium bilamellatum* in Panama. Some plants were located, but the natives refused to ascend the trees since past experience told them that the stinging ants would swarm out to greet them. The only way to obtain the plants, then, was to fell the tree, and cut off the branches with the attached plant. The best and safest method to rid the pseudobulbs of the ants was to drop the branch in a lake or some near-by stream, but in this case there was no water close at hand; and the ant-inhabiting plants had to be carried two miles through the jungle to the car. Two saplings about twelve feet long were cut, the plants tied between, and the two-mile jungle trip was started. About every five minutes a stop was made to brush off the stinging ants from the saplings before they reached the shoulders. At any rate the plants were brought back and are now in the Garden orchid collection.

G. H. P.

THE KILLDEER

Many people are wholly unaware of the help that birds give in the growing of plants, but that they aid in the constant warfare upon insects is apparent to most gardeners. When some unusual incident in bird life presents itself during gardening operations, it always arouses a great deal of

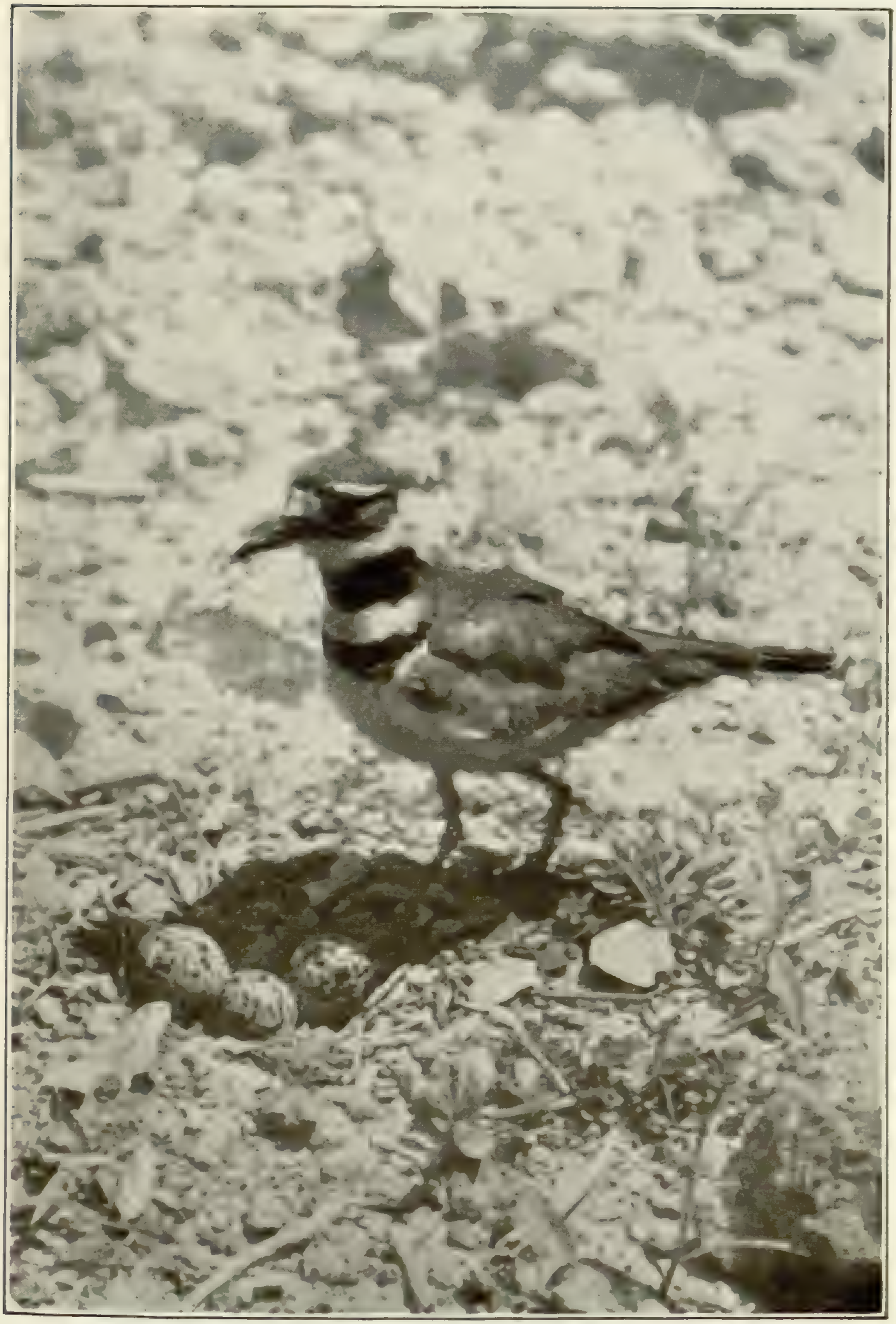
interest; hence this story of the killdeer, sometimes called the noisy plover.

The killdeer is not an uncommon bird at the Garden, as it is always seen and heard during the spring and summer. Some of these birds were observed during the wet spring in the lily pools in front of the palm house. Although these pools had been drained, they resembled a marsh on account of the continuous rainfall. When the field in the nursery was being disked in late May, the noisy scolding of a killdeer, presumably the male, soon led to the discovery of a nest containing four speckled eggs. The nest itself consisted of a slight depression in the soil and was lined with stone chips picked up from the plowed field, remnants of a road which at one time passed through this part of the nursery. This is the first time the killdeer has been known to nest in the Garden, at least to the author's knowledge, but it is possible that when the Garden was not so completely surrounded by dwellings it did nest in this locality. Presumably the wet spring, the marshy pools, and the nearby plowed fields, were the contributing factors that induced this pair of killdeers to remain and nest in the Garden less than three hundred feet away from Tower Grove Avenue.

As a subject for the photographer this bird is most accommodating. The male is frequently in the field and is the first to sound the alarm of the approach of some person. The female immediately leaves the nest, utters a few low calls, then runs about and spreads and flutters its wings, exposing the cinnamon-brown feathers beneath the tail. This of course is done to attract the attention away from the nest. As soon as the camera is set within three feet of the nest the photographer retreats with the string which operates the shutter of the camera, to some tall grass at the edge of the field. After a few moments the bird returns, unafraid of the camera, and prepares to sit on the nest. The click of the shutter frightens the bird and it runs a few feet away, but immediately returns. Some birds abandon their nests when discovered, but not this killdeer.

At the time of this writing, June 14, the bird is still on the nest.

P. A. K.



A KILLDEER IN THE GARDEN

NOTES

Dr. Hermann von Schrenk, Pathologist to the Garden, has been elected vice-president of the American Society for Testing Materials.

Dr. Morris Moore, formerly Rufus J. Lackland Research Fellow in Botany, attended the summer meetings of the Botanical Society of America, at Chicago, June 19-22.

Dr. George T. Moore, Director of the Garden, spoke at the meeting of the Supervisors of St. Luke's Hospital, at the Nurses' Home, June 1, on "The Missouri Botanical Garden."

Mr. G. H. Pring, Superintendent of the Garden, acted as judge at the annual flower show of the Associated Garden Clubs, at the Kirkwood High School, June 10.

Prof. M. B. Dorner, Professor of Floriculture, and Prof. S. W. Hall, Associate Professor of Floriculture, University of Illinois, Urbana, Ill., visited the Missouri Botanical Garden Arboretum, May 27.

Mr. L. P. Jensen, Manager Missouri Botanical Garden Arboretum, was elected president of the Watson-Antire Regionway Improvement Association, organized at the Arboretum, June 4.

Recent visitors to the Garden include Mr. Ora M. Clark, of Bristol, Oklahoma; Miss Julia R. Lawrence, Instructor in Botany, Vassar College, Poughkeepsie, New York; Dr. George M. and Dr. Joanne Karrer Armstrong, the former, Head, Department of Botany and Bacteriology, Clemson College, Clemson College, South Carolina.

Mr. G. H. Pring, Superintendent of the Garden, has made the following talks during the month: June 2, before the St. Louis Horticultural Society, "Water-lilies: Cultivating and Breeding"; June 7, at noon, before the Scottish Rite Woman's Club, "Orchids"; June 7, at 8 o'clock, before the Boulevard Heights Improvement Association, "St. Louis Gardens"; June 21, before the Valley Park Lion's Club, "Jungle Experiences."

A class for the study of Trees and Shrubs will be conducted at the Garden for thirty-five Girl Scouts, on Monday, Wednesday, and Friday of each week, beginning June 19.

The lectures will be given by Dr. David C. Fairburn and Mr. A. P. Beilmann, and will be supplemented with field trips. Subjects to be studies are listed in order as follows: June 19, The parts of a tree; June 21, The life history and processes of trees; June 23, How to estimate the age of trees; June 26, Identifications of trees and shrubs in leaf; June 28, How to prune trees and repair injuries; June 30, The protection of trees and shrubs against insects and diseases; July 3, Planting of seedling trees; July 5, List of woods and their uses; July 7, The best kind of trees to plant in a small garden, around the school, and along streets; July 10, Identification of trees and shrubs by bark, leaf scars, and buds.

STATISTICAL INFORMATION FOR MAY, 1933

GARDEN ATTENDANCE:

Total number of visitors	32,643

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought	33
Total number of books and pamphlets donated	58

PLANT ACCESSIONS:

Total number of plants and seed packets donated	538

HERBARIUM ACCESSIONS:

By Purchase—

Dodge, Professor Carroll W.—Plants of Gaspé Peninsula, Quebec, and British Columbia	354
Killip, Ellsworth P.—Plants of Peru collected by Dr. G. Klug	225
Weigel, Th. Oswald—J. Weese, "Eumycetes selecti exsiccati," Nos. 576-600 incl.	25

By Gift—

Bettis, Mrs. James R.—*Thaspium trifoliatum* Britt. from Missouri	1
Bowman, Miss Helen—*Acer campestre* L., cultivated specimens from Missouri	2
Conzatti, Professor C.—Plants of Mexico	4
Dodge, Professor Carroll W.—Plants of Costa Rica	23
Dodge, Professor Carroll W.—Plants of Indo-China	6
Harper, Professor Roland M.—Plants of Alabama	6
Larson, J. P.—*Crataegus* sp. from horticulture	3
von Schrenk, Dr. Hermann—*Rumex verticillatus* L. from Missouri	1

By Exchange—

Field Museum of Natural History—Plants of Hawaii	21
University of Missouri, by Dr. Francis Drouet—Plants of Missouri	150
Total	821

SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date to the death of Mr. Shaw, in 1889, the Garden was maintained under the personal direction of its founder, and, while virtually a private garden, it was, except at certain stated times, always open to the public. Although popularly known as "Shaw's Garden" the name Missouri Botanical Garden was designated by Mr. Shaw as its official title and in his will or in any of his writings he specifically referred to it as the "Missouri Botanical Garden." By a provision of Mr. Shaw's will the Garden passed at his death into the hands of a Board of Trustees. The original members of the Board were designated in the will, and the Board so constituted, exclusive of certain ex-officio members, is self-perpetuating. By a further provision of the will, the immediate direction of the Garden is vested in a Director, appointed by the Board of Trustees. The Garden receives no income from city or state, but is supported entirely from funds left by the founder.

The city Garden comprises 75 acres, where about 12,000 species of plants are growing. There is now in process of development a tract of land of over 1,500 acres outside the city limits which is to be devoted to (1) the propagation and growing of plants, trees, and shrubs, designed for showing either indoors or outside, at the city Garden, thus avoiding the existing difficulties of growing plants in the city atmosphere; (2) gradually establishing an arboretum as well as holding a certain area as a forest reservation, with the idea that possibly at some future time this may become the new botanical garden.

The Garden is open to the public every day in the year, except New Year's Day and Christmas—week days from 8:00 a. m. until one-half hour after sunset; Sundays from 10 a. m. until sunset.

The main entrance to the Garden is located at Tower Grove Avenue and Flora Place, on the Sarah car line (No. 42). Transfer south from all intersecting lines. The Garden may also be reached by Bus Route No. 12, to which all other motor-bus lines transfer.

STAFF
OF THE MISSOURI BOTANICAL GARDEN

THE GARDEN, 2315 TOWER GROVE AVENUE, ST. LOUIS, MISSOURI

GEORGE T. MOORE,
Director

KATHERINE H. LEIGH,
Assistant to the Director

HERMANN VON SCHRENK,
Pathologist

CARROLL W. DODGE,
Mycologist

JESSE M. GREENMAN,
Curator of Herbarium

ROLAND V. LAGARDE,
Research Assistant

ERNEST S. REYNOLDS,
Physiologist

ROBERT E. WOODSON, JR.,
Research Assistant

NELL C. HORNER,
Librarian and Editor of Publications

GEORGE H. PRING,
Superintendent

JOHN NOYES,
Consulting Landscape Architect

PAUL A. KOHL,
Floriculturist

WILLIAM F. LANGAN,
Chief Engineer

JOHN H. KELLOGG,
Plant Collector

JOSEPH LANGEN,
Assistant Engineer

AUGUST P. BEILMANN,
Arboriculturist

ARTHUR D. FORRESTER,
Plant Recorder

JOSEPH CUTAK,
In charge of Exotics

ALBERT PEARSON,
Painter

LADISLAUS CUTAK,
In charge of Succulents

THE ARBORETUM, GRAY SUMMIT, MISSOURI

LARS P. JENSEN,
Manager

GUSTAVE GOEDEKE,
Foreman

DAVID MILLER,
Orchid Grower

ROY E. KISSECK,
Engineer

TROPICAL STATION, BALBOA, CANAL ZONE

A. A. HUNTER,
Manager

REPRESENTATIVE IN EUROPE

GURNEY WILSON, F. L. S.
Hove, Sussex, England

MISSOURI BOTANICAL GARDEN BULLETIN

Vol. XXI SEPTEMBER, 1933 No. 7

CONTENTS

	Page
Dry Sand Treatment for Preserving Flowers	105
Winter Care of Cacti	107
New or Noteworthy Plants for St. Louis. IV. Albizzia Julibrissin (Silk Tree)	108
Grammatophyllum multiflorum	109
Notes	110
Statistical Information	111

ST. LOUIS, MO.
1933

Published Monthly, Except July and August, by the Board of Trustees

SUBSCRIPTION PRICE:

ONE DOLLAR PER YEAR SINGLE COPIES TEN CENTS

BOARD OF TRUSTEES
OF THE MISSOURI BOTANICAL GARDEN

THE ORIGINAL MEMBERS WERE DESIGNATED IN MR. SHAW'S WILL AND THE BOARD SO CONSTITUTED, EXCLUSIVE OF THE *EX-OFFICIO* MEMBERS, IS SELF-PERPETUATING

President
GEORGE C. HITCHCOCK

Vice-President
SAMUEL C. DAVIS

Second Vice-President
DANIEL K. CATLIN

L. RAY CARTER

THOMAS S. MAFFITT

GEORGE T. MOORE

ALBERT T. PERKINS

EUGENE PETTUS

ETHAN A. H. SHEPLEY

FRED G. ZEIBIG

***EX-OFFICIO* MEMBERS**

GEORGE R. THROOP
Chancellor of Washington University

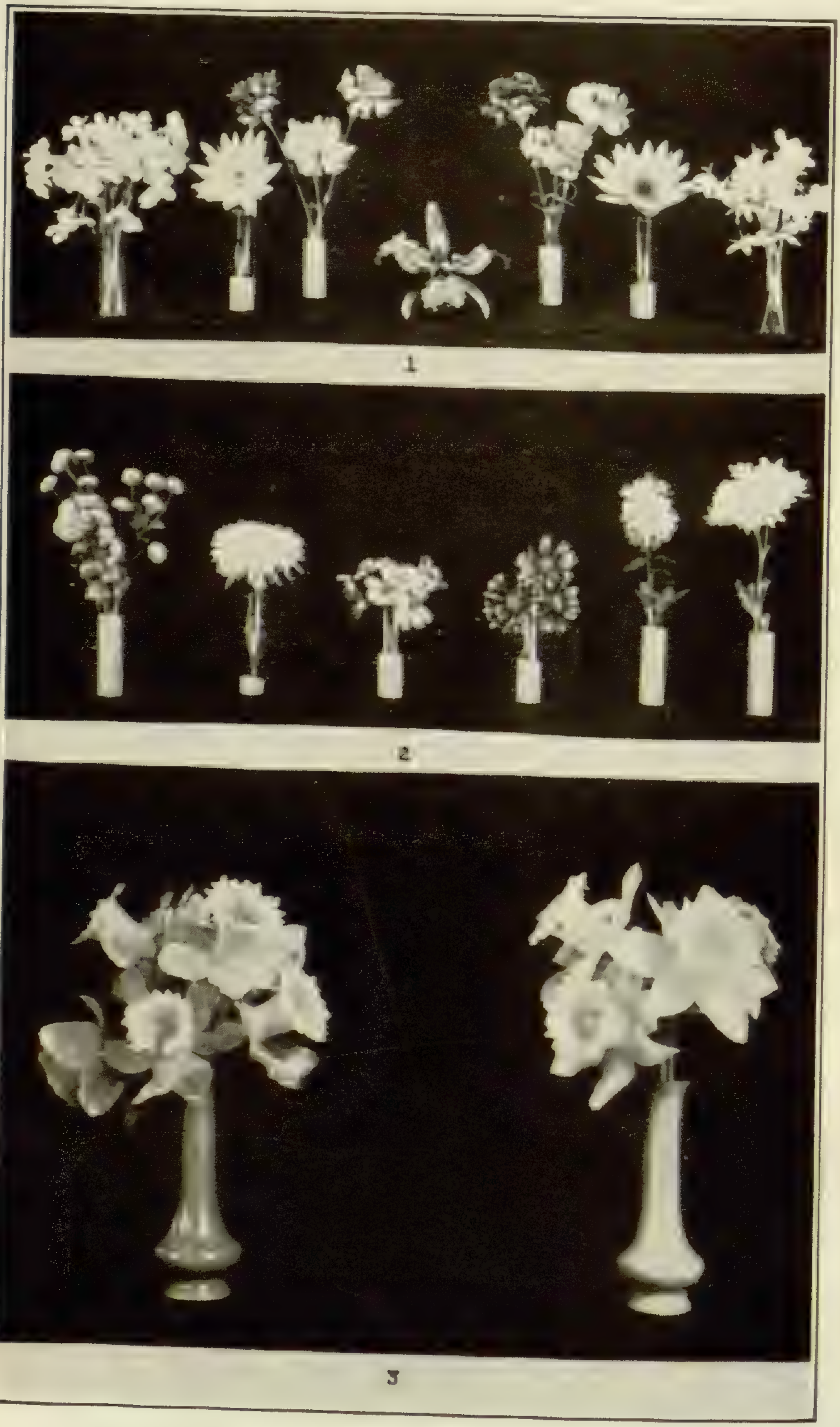
BERNARD F. DICKMANN,
Mayor of the City of St. Louis

FREDERICK F. JOHNSON,
Bishop of the Diocese of Missouri

ALBERT KUNTZ,
President of The Academy of Science of St. Louis

DAVID C. TODD
President of the Board of Education of St. Louis

Secretary
GEORGE F. HEFFERNAN



1

2

3

DRY SAND TREATMENT FOR PRESERVING FLOWERS

1. Orchids, carnations, water-lilies, and narcissi.
2. Chrysanthemums, cosmos, and gaillardias.
3. Dried (left) and fresh daffodils.

Missouri Botanical
Garden Bulletin

Vol. XXI SEPTEMBER, 1933 No. 7

DRY SAND TREATMENT FOR PRESERVING FLOWERS

No comprehensive method for preserving permanently the natural color and form of perishable cut-flowers has yet been advanced. The problem is most difficult, for the colors fade out quickly and the floral parts either drop off or disintegrate beyond recognition. Experiments at the Missouri Botanical Garden have shown that the sand process is one of the most successful ways to preserve flowers for a length of time.

No special kind of sand is required, but it must be dry, clean, and not too coarse. Excellent results may be obtained with white sand sifted through a 40-mesh grading screen and heated in an oven to dry off the moisture. Various types of containers may be used, but large clay pots are especially well adapted for the purpose. The drainage hole in the bottom of the pot should be covered with thick paper and about two inches of sand added. Freshly cut flowers are then placed in the sand, stems downward, not too close together. The stems should be of such length that the tops of the flowers are just below the rim of the pot. It is vitally important that the flowers and foliage be dry when placed in the sand. With proper care the sand can be poured in and around the flowers until they are completely buried without injuring their natural shape. The pot should be labelled with the name of the flower and the date, then placed in a dry room where it should remain undisturbed for five or six weeks. Some flowers require a longer drying period than others.

In removing the dried specimens gradually invert the pot and carefully pour out the sand. This is the crucial point of the story. If good judgment were used in selecting the flowers and the proper drying conditions provided, one need not hesitate to proceed with the unveiling for usually a delightful surprise follows. On the other hand, if old decrepit flowers and wet sand were used, one is doomed to bitter disappointment as the bedraggled specimens in an advanced state of decomposition are uncovered. Grains of sand which may adhere to the dried flowers should be brushed off, being careful not to break the tissue which is very fragile after drying.

Flowers and foliage preserved by the sand process will retain their color and shape for a long time if not exposed to dampness, sun, wind, or dust. The protection of a Bell jar is often necessary. In selecting flowers avoid those which drop their petals easily. Tulips, flax, poppies, and roses in full bloom are usually unsatisfactory subjects. Trumpet-shaped and fluted flowers are quite difficult to bury in the sand without ruining their shapes, although fine results may be attained with daffodils, orchids, and possibly many others of similar type. Snapdragons, Spanish iris, and large fancy chrysanthemums are practically impossible to manipulate in the sand satisfactorily. Ruffled or crinkled flowers also require special care, since these attractive features are liable to become sadly distorted. Small flowers, such as daisies, lend themselves to the sand treatment far better than large limber-petaled types such as German iris.

The color of the flower has much to do with the success of the drying process. Certain colors fade miserably in the sand, while others change but slightly. However, all colors lose some of their original intensity during the drying treatment, and therefore one can hardly expect a brilliant showing from delicately tinted flowers. Purple often degenerates into a dull characterless shade. Deep red, pink, blue, orange, yellow, and pure white offer the best possibilities.

A few of the flowers which respond well to drying are: cosmos, gaillardias, water-lilies, zinnias, corn-flowers, yarrows, cockscombs, narcissus, daisies, small, single and double chrysanthemums, orchids, marigolds, carnations, and rose buds when the petals are just starting to unfold. Some of these

are illustrated in plate 26. Iris, poppies, tulips, day-lilies, and portulacas are total failures in the sand. Both of these groups can be greatly amplified.

The simplicity of the sand process, combined with the striking results often achieved, makes the drying of flowers an interesting experiment worthy of some consideration.

D. C. Fairburn.

WINTER CARE OF CACTI

Many people are under the impression that cacti need no attention whatsoever, and consequently their plants seldom survive the second season. Winter is a dangerous time in the life of the cactus plants, but when proper conditions of temperature, water, etc., are given they will thrive. It is the purpose of this article to deal with the winter care of these tough-skinned succulents.

Some cacti are indigenous to cold climates and during the winter months lie under a blanket of snow, whipped by bitter winds. Nature has endowed them to withstand the cold of the Southwest, but they will perish quickly if left out over the winter in the Middle West. It is not the low temperature that would play havoc with them, but the excessive dampness, combined with cold. In St. Louis, and generally the Middle West, all cacti which have been planted out of doors during the summer months should be brought inside about the end of September. The dead line is October 1, after which good weather cannot be assured and frosts are likely.

Probably the greatest mistake of most cacti culturists is that of keeping the plants at too high a temperature during winter. Plants kept in warm rooms tend to grow and when growing they require water. However, when given water the chances for blooms the following year are very small. It should be borne in mind that many cacti naturally live in regions of cold winters and that low temperatures mean suspension of growth. Nature has thus provided a season of rest for cacti, and they do best if left dormant for a few months. Keep them in a cool place (about 50° F.) and in a dry atmosphere.

In their active season (growing period) cacti are able to store sufficient water in their stems for protection against many months of drought, and when watered abundantly in their resting period there is great danger of rot. The best method of watering is to set the plants in a bath-tub filled with water to within half inch of the rims of the pots and leave them there until moisture shows through the soil (plate 27). This method should be used for those cacti kept in living-rooms, and if the plants are thoroughly soaked it need only be done every two to three weeks. The plants that are wintered in cool basements should be watered sparingly once a month.

Sunlight plays an important role in plant life but since sun cannot be assured in winter, give all the light possible by keeping the plants in a window recess. Air is another important factor which should not be overlooked. The cacti wintered indoors will be greatly benefitted if placed outside during occasional warm spells in the winter.

L. C.

NEW OR NOTEWORTHY PLANTS FOR ST. LOUIS. IV

ALBIZZIA JULIBRISSIN (SILK TREE)

This genus was named in honor of Albizzi, an Italian naturalist who is reputed to have introduced it into cultivation. It is a member of the Leguminosae, or pea family, and is closely related to the Acacia, formerly having been placed in that genus.

Albizzia Julibrissin, commonly called silk tree on account of the silk-like tassels of the flowers, is native of temperate Asia from Persia to Japan, but is frequently cultivated in the southern United States as far north as Virginia. It is a deciduous tree, attaining a maximum height of forty feet. The leaves are bipinnate, with up to twenty-five pinnae, each with forty to fifty leaflets. The flowers are showy, light pink, in tassel-like clusters on slender peduncles, crowded at the upper end of the branches. They bloom over a period of six weeks or more during July and August. The fruit is a thin pod, about six inches long.

WATERING CACTI FROM BELOW

FLOWER CLUSTER OF ALBIZZIA JULIBRISSIN

FRUIT OF ALBIZZIA JULIBRISSIN

The plants in the Garden Arboretum are about eight years old. They are large spreading shrubs twelve feet high, and produced the first flowers this season. They seem to be well adapted to our variable climatic conditions, being very drought resistant and starting growth late enough in the spring to escape injury by late frost. In the winter the plant has a rather stiff appearance, but in the summer and autumn, when clothed with its large compound leaves, it becomes one of the most airy and graceful of our ornamental woody plants.

Like most of the legumes, this species is easily propagated from seeds. The seed-frame should be carefully prepared, and a mulch of sand, or preferably, ground peat should be applied after seeding. As a winter protection the frame should be filled with dry leaves which should be removed in early spring.

L. P. J.

GRAMMATOPHYLLUM MULTIFLORUM

Grammatophyllum is an interesting genus of orchids with few species, and noted for its giant specimens. The stem-like pseudobulbs of *Grammatophyllum speciosum* are up to 10 feet long, and the huge flower spikes possess 70-100 flowers.

Two plants of *Grammatophyllum multiflorum*, in excellent condition, were included in the collection sent to the Garden in 1931 from the Philippines by Governor General Dwight F. Davis. This species might easily be mistaken for a Cymbidium, and differs entirely from *G. speciosum* whose growth habit rather resembles a Dendrobium. The plants were allowed to remain in the native baskets in which they arrived, were given a top dressing of peat, and hung up in the Vanda house at the Arboretum. During May both plants produced two flower spikes which bloomed for a month. (plate 29).

The spike is 2 feet long, growing in a graceful curving fashion from the mature bulb, 70-80 greenish-yellow flowers produced on a spike. The labellum, or lip, is 3-parted, with lateral wings protecting the column, yellowish-green striped with purple, the central lobe, which extends beyond the column, being white, green towards the apex, striped with purple. The column is curved, white, spotted with rose-purple on the under side. The sepals are about 1 inch long, $\frac{3}{8}$ inch

wide, ovate-lanceolate, greenish-yellow prominently marked with chocolate color. The petals are about 1 inch long, ¼ inch wide, the same color and markings as the sepals, the brown color showing through the under sides in both cases. The leaves are dark green, strap-shaped, 2 feet long, about 2¾ inches wide, with 8 prominent veins, and are attached to the apical portion of the developed bulb. The pseudobulbs are ovate to oblong, 5 inches long, 2 inches wide (in cultivated specimens), closely resembling Cymbidium in growth.

G. H. P.

NOTES

Mr. George H. Pring, Superintendent of the Garden, has been elected president of the St. Louis Florists' Club.

Mr. George H. Pring spoke before the South Side Optimist Club, July 5, on "Optimistic Plants."

Mr. George H. Pring is the author of an article in the New York Times, July 25, on "Collection of Water-lilies."

The Watson-Antire Regionway Improvement Association held a meeting at the Missouri Botanical Garden Arboretum, Gray Summit, September 10.

Mr. L. P. Jensen, Manager Missouri Botanical Garden Arboretum, attended the convention of the American Institute of Park Executives, Chicago, September 17-21.

The August, 1933, number of "Rhodora" contains an article entitled "Notes on Missouri Plants" by J. A. Steyermark, who held a Rufus J. Lackland Research fellowship at the Garden during the past several years.

The "Florists Review" for July 13 contains a reprint of the article recently published in the MISSOURI BOTANICAL GARDEN BULLETIN by Mr. G. H. Pring, entitled "Tropical Lilies of Unusual Interest Produced by Hybridizers."

Dr. Ernest S. Reynolds, Physiologist to the Garden, read a paper at the "Radiation and Plant Life Symposium," June 22, at the summer meetings of the Botanical Society of America, Chicago, on "Growth as a Criterion for Physiological Response to Radiations."

Number 2 of Volume XX, of the ANNALS OF THE MISSOURI BOTANICAL GARDEN was issued during the summer, and con-

GRAMMATOPHYLLUM MULTIFLORUM

tains the following papers: "A Revision of the North American Species of Verbena" by Lily M. Perry, and "Nutrient Solutions for Orchids" by F. Lyle Wynd.

Visitors to the Garden during the summer months include: Mr. Chunling Chung, of Canton Christian College, China; Mrs. Ellen Rooksby, editor "Desert Magazine," Pasadena; Dr. Ethel Eltinge, instructor in botany, Mt. Holyoke College, South Hadley, Mass.; Mr. W. J. Manda, orchid specialist, of West Palm Beach, Florida; Mr. E. J. Palmer, collector, Arnold Arboretum, Jamaica Plain; Dr. H. R. Rosen, professor of plant pathology, University of Arkansas; Dr. Albert C. Saeger, head, department of biology, Junior College of Kansas City; Dr. E. E. Sherff, head department of science, Chicago Normal College, Chicago.

STATISTICAL INFORMATION FOR JUNE-AUGUST, 1933

GARDEN ATTENDANCE:

Total number of visitors in June	21,401
Total number of visitors in July	26,965
Total number of visitors in August	35,554

PLANT ACCESSIONS:

Total number of plants and packets of seeds donated in June	227
Total number of plants and packets of seeds donated in July	541
Total number of packets of seeds donated in August	25

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought in June	8
Total number of books and pamphlets donated in June	48
Total number of books and pamphlets bought in July	14
Total number of books and pamphlets donated in July	316
Total number of books and pamphlets bought in August	26
Total number of books and pamphlets donated in August	73

HERBARIUM ACCESSIONS:

JUNE

By Purchase—

Gleason, Dr. H. A.—Plants of Brazil, collected by Krukoff	270
Weigel, Th. Oswald—Plants of Bolivia, collected by Dr. O. Buchtien	175

By Exchange—

Botanical Museum, University of Cluj, by Dr. Al Borza—Plants of Roumania, Cent. XI, Nos. 1001-1100 inclusive	100
Ewan, Joseph Andorfer—Plants of California	43
Salgues, Dr. R—Miscellaneous plant materials	26

By Gift—
Bakke, Prof. A. L.—Plants of Iowa 7
Burton, J. W.—Plants of Colorado 34
Estate of Hon. Joseph R. Churchill (a bequest)—Private herbarium estimated at 12,000
Deam, C. C.—*Tradescantia brevicaulis* and *T. virginiana* from Indiana 8
Denison, E.—*Talinum calycinum* Engelm. from Missouri 2
Krauth, Mrs. S. E.—*Caesalpinea Gilliesii* Wall. from horticulture 1
Lodewyks, Maude C.—Plants of Missouri 48
Lynch, Mrs. J. T.—*Clematis* from Michigan 1
Moran, Mrs. Robert—*Browallia viscosa* HBK. from horticulture 1
Pepoon, Dr. H. S.—*Plantago* sp. from Illinois 1
Pring, George H.—*Albizzia Julibrissin* Durazz. from horticulture 1
Thomas, Mrs. J.—*Kyllinga pumila* Michx. from Missouri 1
Tuttle, Mrs. George M. — *Cacalia atriplicifolia* L. from Missouri 1
University of Oklahoma, by Professor Paul B. Sears—*Phoradendron flavescens* (Pursh) Nutt. from Oklahoma 1

Total 12,721

JULY

By Purchase—
Aellen, Professor Paul—Plants of Corsica 150
Porsild, Dr. Morten P.—Plants of Greenland 225
By Exchange—
Aellen, Professor Paul—Plants of Switzerland 189
's Rijks Herbarium—Photographs of herbarium specimens . . . 4
U. S. National Herbarium—*Sphaeralcea* from southwestern United States 20
By Gift—
Barkley, Professor F. A.—Plant of Oklahoma 1
Denniston, Professor R. H.—*Populus berolinensis* Dipp. from horticulture 1
Goodman, Dr. George J.—Plants of California 2
Greenman, Dr. J. M.—*Polygala Nuttallii* T. & G. from Connecticut 1
Greenman, Dr. J. M.—Photographs of *Senecio* 22
Prunty Seed and Grain Company—Grass of horticulture 1
Tisdale, L. E.—Plants of Florida 16

Total 632

AUGUST

By Purchase—
Pilat, Dr. Albert—"Fungi Carpatici Lignicoli," Fasc. I, Nos. 1-50 inclusive 50
Schipp, W. A.—Plants of British Honduras 129

By Gift —
Greenman, Dr. J. M.—Plants of Missouri 4
Harrison, Professor B. F.—Plants of Utah 140
Purer, Miss Edith A. —*Senecio californicus* DC. from California 1
By Exchange—
Maguire, Professor Bassett—Plants of Glacier National Park, Montana 42
University of Michigan by Professor H. H. Bartlett—Plants of Central America 26

Total 392

SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date to the death of Mr. Shaw, in 1889, the Garden was maintained under the personal direction of its founder, and, while virtually a private garden, it was, except at certain stated times, always open to the public. Although popularly known as "Shaw's Garden" the name Missouri Botanical Garden was designated by Mr. Shaw as its official title and in his will or in any of his writings he specifically referred to it as the "Missouri Botanical Garden." By a provision of Mr. Shaw's will the Garden passed at his death into the hands of a Board of Trustees. The original members of the Board were designated in the will, and the Board so constituted, exclusive of certain ex-officio members, is self-perpetuating. By a further provision of the will, the immediate direction of the Garden is vested in a Director, appointed by the Board of Trustees. The Garden receives no income from city or state, but is supported entirely from funds left by the founder.

The city Garden comprises 75 acres, where about 12,000 species of plants are growing. There is now in process of development a tract of land of over 1,500 acres outside the city limits which is to be devoted to (1) the propagation and growing of plants, trees, and shrubs, designed for showing either indoors or outside, at the city Garden, thus avoiding the existing difficulties of growing plants in the city atmosphere; (2) gradually establishing an arboretum as well as holding a certain area as a forest reservation, with the idea that possibly at some future time this may become the new botanical garden.

The Garden is open to the public every day in the year, except New Year's Day and Christmas—week days from 8:00 a. m. until one-half hour after sunset; Sundays from 10 a. m. until sunset.

The main entrance to the Garden is located at Tower Grove Avenue and Flora Place, on the Sarah car line (No. 42). Transfer south from all intersecting lines. The Garden may also be reached by Bus Route No. 12, to which all other motorbus lines transfer.

STAFF
OF THE MISSOURI BOTANICAL GARDEN

THE GARDEN, 2315 TOWER GROVE AVENUE, ST. LOUIS, MISSOURI

GEORGE T. MOORE
Director

KATHERINE H. LEIGH,
Assistant to the Director

HERMANN VON SCHRENK,
Pathologist

JESSE M. GREENMAN,
Curator of Herbarium

ERNEST S. REYNOLDS,
Physiologist

CARROLL W. DODGE,
Mycologist

ROBERT E. WOODSON, JR.
Research Assistant

NELL C. HORNER,
Librarian and Editor of Publications

GEORGE H. PRING
Superintendent

JOHN NOYES,
Consulting Landscape Architect

WILLIAM F. LANGAN,
Chief Engineer

JOSEPH LANGEN,
Assistant Engineer

ARTHUR D. FORRESTER,
Plant Recorder

ALBERT PEARSON,
Painter

PAUL A. KOHL,
Floriculturist

JOHN H. KELLOGG,
Plant Collector

AUGUST P. BEILMANN,
Arboriculturist

JOSEPH CUTAK,
In charge of Exotics

LADISLAUS CUTAK,
In charge of Succulents

THE ARBORETUM, GRAY SUMMIT, MISSOURI

LARS P. JENSEN,
Manager

GUSTAVE GOEDEKE,
Foreman

DAVID MILLER,
Orchid Grower

ROY E. KISSECK,
Engineer

TROPICAL STATION, BALBOA, CANAL ZONE

A. A. HUNTER
Manager

REPRESENTATIVE IN EUROPE

GURNEY WILSON, F. L. S.
Hove, Sussex, England

MISSOURI BOTANICAL GARDEN BULLETIN

Vol. XXI OCTOBER, 1933 No. 8

CONTENTS

	Page
The Story of the Dendrobium Orchid	115
New or Noteworthy Plants for St. Louis V. *Pterocarya Rehderiana* Schneider (Wing-nut)	120
The Flora of Postage Stamps	122
Notes	125
Statistical Information	126

ST. LOUIS, MO.
1933

Published Monthly, Except July and August, by the Board of Trustees

SUBSCRIPTION PRICE:

ONE DOLLAR PER YEAR SINGLE COPIES TEN CENTS

BOARD OF TRUSTEES
OF THE MISSOURI BOTANICAL GARDEN

THE ORIGINAL MEMBERS WERE DESIGNATED IN MR. SHAW'S WILL
AND THE BOARD SO CONSTITUTED, EXCLUSIVE OF THE
EX-OFFICIO MEMBERS, IS SELF-PERPETUATING

President
GEORGE C. HITCHCOCK

Vice-President
SAMUEL C. DAVIS

Second Vice-President
DANIEL K. CATLIN

L. RAY CARTER

ALBERT T. PERKINS

THOMAS S. MAFFITT

EUGENE PETTUS

GEORGE T. MOORE

ETHAN A. H. SHEPLEY

FRED G. ZEIBIG

EX-OFFICIO MEMBERS

GEORGE R. THROOP,
Chancellor of Washington University

BERNARD F. DICKMANN,
Mayor of the City of St. Louis

FREDERICK F. JOHNSON,
Bishop of the Diocese of Missouri

ALBERT KUNTZ,
President of The Academy of Science of St. Louis

DAVID C. TODD
President of the Board of Education of St. Louis

Secretary
GEORGE F. HEFFERNAN

DENDROBIUM PHALAENOPSIS VAR. SCHROEDERIANUM
PARENT PLANT (LEFT) AND THREE SEEDLINGS FROM IT

Missouri Botanical Garden Bulletin

Vol. XXI OCTOBER, 1933 No. 8

THE STORY OF THE DENDROBIUM ORCHID

The first orchid flowers to be grown from seed at the Garden were used this year in the bouquet of the Veiled Prophet's Queen. The flower from which the seed were obtained was pollinated on October 15, 1928. Eight months were required from the time of pollination to the ripening of the seed. The seed were sown in June, 1929, and three years and three months afterwards, that is, October a year ago, the larger seedlings bore one or two small flowers. This year in October the plants produced normal spikes, bearing in some cases as many as eight flowers, and these were the ones used in the Queen's bouquet.

Thus five years elapsed from the time of pollination of the parent plant to the production of normal spikes on the seedling. While not a record so far as the genus Dendrobium is concerned, the time is somewhat shorter than for the more showy Cattleya flowers, which usually require at least six years from pollination to blooming, and in some cases it may be as long as ten years before the first flowers appear.

The original species of this Dendrobium seedling, known botanically as *Dendrobium Phalaenopsis* var. *Schroederianum,* has an interesting history. Like the discovery of many of the orchids now grown commercially or by amateurs, the story of their first finding is often dramatic, and frequently involved hardships and dangers not ordinarily associated with the collection of plants. The following

account, taken from Boyle's "The Woodlands Orchids," published in 1901, is abstracted here both because of its interest in connection with the seedlings now growing at the Garden, and because it vividly portrays the adventures of an orchid hunter in the discovery of the original parent of one of the most beautiful and satisfactory spray orchids growing in the Garden collection:

"Many who care nothing for our pleasant science recall the chatter and bustle which greeted the reappearance of Dendrobium Schröderianum in 1891. For they spread far beyond the 'horticultural circles.' Every newspaper in the realm gave some sort of a report, and a multitude of my *confrères* were summoned to spin out a column, from such stores of ingenuity as they could find, upon a plant which grew on human skulls and travelled under charge of tutelary idols. . . .

"The variety of Dendrobium Phalaenopsis hereafter to bear Baron Schröder's name was sent to Kew by Forbes about 1857. This single plant remained a special trophy of the Royal Gardens for many years. It throve and multiplied. In course of time Sir Joseph Hooker was able to give a small piece, in exchange for other varieties, to Mr. Day, of Tottenham, to Baron Schröder, and to Messrs. Veitch. The latter sold their specimen to Baron Schröder; Mr. Day's collection was dispersed, and the same greatest of amateurs bought his fragment. Thus all three plants known to exist in private hands came into Baron Schröder's possession, and the variety took his name.

"This state of things lasted ten years. Mr. Sander then resolved to wait no longer upon chance. He studied the route of Forbes's travels, consulted the authorities at Kew, and, with their aid, came to a conclusion. In 1890 my friend Mr. Micholitz went out to seek Dendrobium Schröderianum in its native wilds.

"The man of sense who finds a treasure does not proclaim the spot till he has filled his pockets, nor even, if it may be, till he has cleared out the hoard. It is universally understood that Micholitz discovered the object of his quest in New Guinea. If that error encouraged the exploration of a most interesting island, as I hear, it has done a public

service. And the explorers have not wasted their time. They did not fall in with Dendrobium Schröderianum, because it was not there; but they secured other valuable things. Very shortly now the true habitat will be declared. Meantime I must only say that it is one of the wildest of those many 'Summer Isles of Eden' which stud the Australasian Sea.

"Micholitz arrived in a trading-vessel, the captain of which was trusted by the natives. Under that protection the chiefs allowed him to explore, agreeing to furnish men and canoes —for a consideration, naturally. Their power did not stretch beyond a few miles of coast; the neighbours on each side were unfriendly, or at least distrusted; and bitterly hostile tribes lay beyond — hostile, that is, to the people among whom Micholitz landed. All alike are head-hunters, and all charge one another with cannibalism—but falsely in every case, I understand.

"The field was narrow, therefore, and uncommonly perilous, for the best-intentioned of these islanders cannot always resist the impulse to crown their trophies with a white man's head—as the Captain assured Micholitz day by day, with an earnestness which became oppressive after a while. But he was very lucky—or rather the probabilities had been studied so thoughtfully before any step was taken that he sailed to the very island. I do not mean that it is wonderful to find an orchid on the first day's search when once its habitat is known. Dendrobiums cover a great tract of land. It is the nicety of calculation ten thousand miles away which should be admired.

"There were no plants, however, just around the little port. After some days spent in making arrangements, Micholitz received an intimation that the chiefs were going to a feast and he might accompany them; there is no lack of interpreters on that coast, whence so many poor wretches are enticed to English or French colonies—some of whom return nowadays. The Captain could not go. In refusing, he looked at Micholitz with a quizzical, hesitating air, as though inclined to make a revelation.

" 'Is there any danger?' Micholitz asked.

" 'Oh, no! not a bit!—not a bit of danger! I answer for that. You'll be amused, I daresay. They're rum chaps.'

"The chance of making a trip beyond the narrow friendly area in safety was welcome, and at daylight he started with the chiefs. It was but a few hours' paddling—to the next bay. The feast was given, as is usual, to celebrate the launching of a war-prau. In martial panoply the guests embarked, paint and feathers, spears and clubs. They were met by their hosts in the same guise upon the beach. After ceremonies probably—but I have no description—all squatted down in a circle, and a personage, assumed to be the priest, howled for a while. Then the warriors began to dance, two by two. It was very wearisome, and besides, very hot. Micholitz asked at length whether he might leave. The interpreter said there was no objection. He walked towards the forest, which stood some distance back, even as a wall, skirting the snowy beach. The grey huts of the village glimmered among palms and fruit-trees on one hand."

Here follows a description of the gruesome rites, involving human sacrifice, which attended the launching of the war-prau:

"Poor Micholitz felt sick . . . he hurried towards the trees. . . .

"But when he reached the trees his business was done. Those horrors had so disconcerted him that for an instant he saw long green stems of orchid perched upon the boughs without regarding them. But here was one from the top of which depended a cluster of rosy garlands, four or five, bearing a dozen, or twenty, or thirty, great flowers, all open; and there a cluster snow-white—a crimson one beyond, darkening almost to purple. Dendrobium Schröderianum was rediscovered!

"Of Micholitz's emotion it is enough to tell that it drove all else from his mind, or almost. When the interpreter summoned him he sat down and hobnobbed with those murderers and ate their dubious viands. The triumph was startling, so speedy and complete; but so much the heavier were his responsibilities. When, with a chilling shock, he recalled distinctly the dread spectacle, he said again:

" 'Let me attend to my business! I can't help it!'

"All went well. So soon as the chiefs understood that this eccentric white man fancied their weeds, they joyously

offered them—at a price. The time of year was excellent—early in the dry season. Next day Micholitz returned aboard, and the Captain brought his ship round to the bay. But he would not listen to the story. 'I told you they was rum chaps, didn't I? Well, you see I told you true.' In three days, so plentiful was the supply, Micholitz had gathered as many as he thought judicious, and heaped them on deck. They could be dried while the vessel was waiting for cargo elsewhere, and he longed to get away from that ill-omened spot.

"Still luck attended him. The Captain 'filled up' quickly, and sailed, as by agreement, for a Dutch port, where the orchids would be shipped for England. He arrived in the evening, the ship lay alongside the wharf; next day his precious cases would be transferred to the steamer. In great content Micholitz went to sleep; so did everybody else, the watch included. Towards the morning the harbour police raised a cry of 'Fire!' It must have been smouldering for hours. Not a plant could poor Micholitz save!

"On arrival, he had telegraphed his success, and joy reigned at St. Albans all day. Foresight and enterprise were justly rewarded for once. What a *coup*—what a sensation! Let us not speculate upon the language used when a second dispatch came in the morning.

"'Ship burnt! What do!—Micholitz.'

"The reply was emphatic: 'Go back.—Sander.'

"'Too late—rainy season.'

"'Go back!'

"And Micholitz went. His protest, had he insisted upon it, was unanswerable. Hard enough it would be to return among those anti-human wretches when the delights of home had been so near. But there was no chance of regaining the bay—a vessel might not sail thither for months or years. The work must be begun again—the search renewed. And in the rainy season, too!

"But the good fellow did not even hesitate. Forthwith he inquired for a ship trading with the island. There was none, and he had no time to wait, for the rain grew heavier daily. A mail steamer was leaving for the nearest settlement.

Trusting to the 'courtesy of nations,' Micholitz claimed a passage as a shipwrecked man. . . .

"I have no space for the adventures of this second journey now. The Dendrobe was found once more, which is not at all surprising when its habitat had been discovered. At this spot, however, it was growing, not on trees, but on rocks of limestone—most epiphytal orchids love to cling on that rough and porous surface. Especially was it abundant in the graveyard of the clan, a stony waste where for generations they had left their dead—not unmourned, perhaps—beneath the sky. The plants grew and flowered among bones innumerable. To suggest the removal of them under such circumstances was a nervous duty. But in the graveyard they were not only most plentiful, but by far most vigorous. It had to be done, and with all precautions, after displaying a sample of his 'trade,' looking-glasses and knives and beads, and so forth, Micholitz did it.

"A clamour of indignation broke out. It was swelling into passion when he produced a roll of brass wire; at that spectacle it suddenly calmed down. After debate among themselves the warriors stipulated that two of their most sacred idols should travel with the plants, and be treated with all honour on the way. They would not assist in collecting, but after the distribution of brass wire they helped to pack the cases.

"Thus it happened that one of the Dendrobes sold at 'Protheroe's' on October 16, 1891, was attached to a human skull. As for the idols, they were bought by the Hon. Walter Rothschild, and we are free to hope that they are treated with reverence, as per agreement."

NEW OR NOTEWORTHY PLANTS FOR ST. LOUIS. V.

PTEROCARYA REHDERIANA SCHNEIDER (WING-NUT)

There are many examples of mimicry in the insect world. Trees, however, are not capable of very rapid changes in appearance, nor have they the same need for masquerading

BRANCH OF PTEROCARYA REHDERIANA SHOWING MATURE SEED (NOTICE WINGED RHACHIS)

PTEROCARYA REHDERIANA (WING-NUT) GROWING IN THE MISSOURI BOTANICAL GARDEN

SHOWING TYPICAL BARK FISSURES OF THE WING-NUT AND NUMEROUS SUCKERS GROWING FROM THE SURFACE ROOTS

in order to protect themselves against enemies. In fact, if a tree succeeded in resembling another of a different genus, it might find itself with even more enemies to combat.

The wing-nut *(Pterocarya Rehderiana* Schneider) is especially interesting because of its close resemblance to several other trees, at a distance being easily mistaken for either a walnut, an ash, or an ailanthus. The winter buds are long and yellow, much like those of the bitter-nut hickory. Even the bark fissures are similar to those of the hickory, but in Pterocarya the exterior bark is very soft, and the inner bark is bright yellow. The wood is light in color and weight, and far different from our native walnuts. The leaves are compound, having from eleven to twenty-one glossy serrate leaflets. The axils of the veins are bearded, and the rhachis is winged. The fruit (pl. 31) is small, inedible, and winged.

The genus Pterocarya is native to China. Seeds of the species *P. stenoptera* were sent to Europe by Calery in 1844. and later were brought to the United States. It was not entirely hardy in the North, but plants grown at the Arnold Arboretum from the seed of this early introduction were much more hardy and differed sufficiently in several additional characteristics to cause Dr. C. K. Schneider to bestow the name *P. Rehderiana* upon it. Presumably it is a hybrid of *P. stenoptera* and *P. fraxinifolia,* both of which were introduced about the same time.

Even though it seems to have so little in common with our native walnuts, it has not escaped being attacked by the walnut caterpiller. This special pest of the walnut feeds greedily on Pterocarya leaves each summer, never attacking trees of any other family. Perhaps the wing-nut has not practiced mimicry long enough to confuse this caterpiller, or this insect may be well versed in detecting the affinities of the true walnut.

Pterocarya Rehderiana is of rapid growth (pl. 32, fig. 1) and somewhat spreading habit. The branches are very flexible, but seem never to be injured by storms. If planted in good deep soil it will stand the driest and hottest summer. It develops a very extensive surface root system, producing an abundance of suckers. This is one objectionable feature, but at the same time it affords a ready means of propagation.

The one mature specimen in the Garden was planted in 1904, since which time it has grown almost one-half inch in diameter each year. Unfortunately it is growing east of the nursery along Tower Grove Avenue, and cannot be seen easily by visitors. Because of its position close to the wall it has assured small boys a dependable exit from the Garden.

A. P. B.

THE FLORA OF POSTAGE STAMPS

It is only in recent years that plants have come into prominence as subjects for illustrations on postage stamps. This may have happened for several reasons: Plants may have proved important in the early settling of a country, but only recently become recognized; there may be a lack of heroes to put on stamps, and thus a government would be forced to use some other design; plant portraits may be used to advertise the agriculture and vegetable products of a country, to encourage colonization; or the country may wish to issue pretty stamps that collectors will be sure to buy.

Upon the stamps of the United States have appeared scenes of wheat harvest on the great plains, with many horses pulling the monstrous machine used to cut, thresh, and sack the grain in one continuous process. The fruit orchards of the state of Washington are shown on one parcel-post stamp. Last year the founding of Arbor Day was commemorated by a 2-cent stamp, which showed a boy and girl planting a small tree. The stamps commemorating the founding of Jamestown bear a picture of maize, or Indian corn, the Indians' food crop which saved the early pioneers from famine. On the same stamp is the tobacco plant, useless then, but which has probably saved many descendants of the colonists from starvation. Indigo, the plant from which a blue dye was formerly prepared, and rice were important plants in the early history of South Carolina, and appear on a stamp (1930) commemorating the two hundred fiftieth anniversary of the founding of the colony and of the city of Charleston.

The names of certain countries are immediately associated in our minds with some object or some tradition. Canada suggests the maple leaf, and we find that maple leaves have ornamented the stamps of Canada for many years. The shamrock and Ireland are so closely associated that we are surprised to find that the stamps of Newfoundland first bore this plant, long before there was an Irish Free State. Now there are real Irish stamps with shamrocks on them. The rising sun of Japan shines on the chrysanthemums, which are so much a part of Japanese life that it seems natural to find them represented on her stamps. Rice recalls China, and on some Chinese stamps (such as type A-30 of Scott's Catalogue) we see farmers wading in the marshy rice fields harvesting the grain. To judge only from their stamps, the Philippines, British Guiana, Sierra Leone, and the Straits Settlements engage extensively in the growing of rice.

The well-known banana is illustrated on the stamps of Liberia; and the closely related travelers' palm, with its two rows of leaves resembling a sparsely plucked chicken's tail, is to be seen on the stamps of those countries where it is native—Liberia, Madagascar, and North Borneo.

The fruits of the curious cacao tree, from which cocoa and chocolate are made, do not occur at the tips of the branches, as do most pods, but grow out from the main trunk of the tree. An especially nice picture of this tree is on the stamps of the 1928 issue of the Gold Coast. Your breakfast cup of coffee in the raw is represented on the stamps of those great coffee countries, Brazil, Liberia, Honduras, and Colombia. A well-ordered plantation of tea bushes is shown on a recent stamp from Mozambique Company, a division of Portugese East Africa.

Tropical scenes usually include columnar stems of palm trees, with their feather-duster-like groups of leaves at the end. Many different kinds of palm trees are used in decorating the stamps of foreign lands. The method of harvesting large clusters of dates is shown on the stamps of Tunis and other French possessions in Africa. The stately curved cocoanut palm appears on the stamps of tropical lands of all continents. It is this plant which produces the largest of

seeds — the cocoanut. A source of palm oil — used in the manufacture of soap — is the species of palm illustrated on a Liberian stamp. Very curious is a stamp from Haiti, in which a palm tree is the central portion of the design. The leaves of the tree curve gracefully upward and outward in the first stamps issued—type A-7. Later the stamp was re-engraved (type A-9) and then the leaves of the palm drooped. It would seem that the artist's model grew older during the two years which elapsed between the appearance of the two stamps.

Cotton, an important crop in the Nile Valley, is used in a recent series of Egyptian stamps commemorating the Cotton Congress of 1927. This important fiber plant is found also on stamps of Peru, Togo, and Mozambique. Various steps in the growth of sugar cane and the manufacture of sugar may be found in a series of stamps, including the following countries—Peru, Ecuador, Guadalupe, Martinique, and Mozambique. Large New Zealand tree ferns decorate the stamps used by the Government Insurance Department.

The succulent spiny cactus has its place on stamps. A native kind is illustrated on the stamps of Turks Islands, a British possession in the West Indies. Upon a stamp of Tripolitania, an Italian colony in North Africa, appears a large prickly pear cactus. This is doubly interesting, because the cactus family grows wild only in North and South America and the species illustrated has been introduced from the western hemisphere.

One of the most extraordinary plants on the face of the earth grows in a very small desert region on the coast of South West Africa, and it is so rare and unusual that a fine of fifty pounds (250 dollars) is imposed on any-one caught digging up the Tumboa plant. The Tumboa plant *(Tumboa Bainesii,* better known as *Welwitschia mirabilis)* produces cones and seeds in the manner of a pine tree, but in every other respect it is unique. The stem is turnip-shaped, slightly hollowed at the top. Growing out from the rim are two broad, flat, dark green, shiny leaves—the only two leaves the plant ever has. These leaves grow throughout the life of the plant, and may reach a length of ten feet or

more before they begin to fray at the edges. On the 10-shilling stamp of South West Africa (1931, type A-46), this strange vegetable has been immortalized.

The olive branch, representing an ideal, appears held in the mouth of a dove, on a Swiss stamp, and also on a Japanese stamp that was issued several years ago.

John Adam Moore.

NOTES

Dr. Bohumil Shimek, professor emeritus of botany, University of Iowa, is spending several weeks in the Garden herbarium, in a study of the flora of Iowa.

The members of the St. Louis Wild Flower Club were guests of the Garden at the Arboretum, October 14, and Mr. L. P. Jensen, Manager of the Arboretum, addressed them on "Regional Planning."

Recent visitors to the Garden include Dr. Nathaniel Gist Gee, vice president, Yenching University, Pieping, China; and Mr. J. Horace McFarland, editor and publisher of the American Rose Annual.

Mr. G. H. Pring, Superintendent of the Garden, spoke before the Caledonian Society, at the Hamilton Hotel, October 9, on "Orchid Exploration," and before the Town Club of St. Louis, October 20, on "The Lost Yellow Water-Lily as a Factor in Breeding."

Mr. L. P. Jensen, Manager of the Arboretum, has given the following talks recently: September 28, before the Gray Summit Home Economics Club, at the Purina Farms, on "How to Plant the Home Grounds"; October 7, before the Gray Summit Garden Club, on "Observations on Gardening in Chicago and Milwaukee"; October 10, before the Garden Club of Sullivan, Mo., on "Garden Club Activities."

The third number of volume XX of the ANNALS OF THE MISSOURI BOTANICAL GARDEN has recently been issued and contains the following papers: "The Foliose and Fruticose

Lichens of Costa Rica," by Carroll W. Dodge; "A Neutral (?) Strain of *Mucor sphaerosporus* from Missouri," and "A Study of *Endomyces capsulatus* Rewbridge, Dodge and Ayers: A Causative Agent of Fatal Cerebrospinal Meningitis," by Morris Moore.

STATISTICAL INFORMATION FOR SEPTEMBER, 1933

GARDEN ATTENDANCE:

Total number of visitors.....23,182

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought..... 9
Total number of books and pamphlets donated..... 248

PLANT ACCESSIONS:

Total number of plants and seed packets donated..... 70

HERBARIUM ACCESSIONS:

By Purchase—

Broadway, W. E.—Plants of Trinidad..... 106
Harper, Roland M.—Plants of Alabama..... 100
Lundell, C. L.—Plants of Yucatan, Guatemala, and British Honduras..... 129
Pilát, Dr. A.—"Fungi Carpatici Lignicoli," Fasc. II, Nos. 51-100 inclusive 50
Valeur, E. J.—Plants of the Dominican Republic..... 150
Weigel, Theodor Oswald—Hamel-Joukov, "Algues des Antilles Francaises," Fasc. III, Nos. 101-150 inclusive 50

By Exchange—

Field Museum of Natural History—Plants of United States, Mexico, and South America..... 128
New York State College of Agriculture at Cornell University by Dr. K. M. Wiegand—Plants of New York and California 625
U. S. Department of Agriculture, Bureau of Plant Industry by Professor A. S. Hitchcock — Grasses of Yucatan and British Honduras..... 46

By Gift—

Allen, Paul—Plants of Colorado..... 176
Conzatti, Professor C. by Dr. H. von Schrenk—Seeds of *Taxodium mucronatum* Ten. from Mexico..... 1
Felippone, Florentino—Plants of Uruguay..... 5
Frey, Edward—Plants of Switzerland and France..... 10
Herter, Dr. G.—Plants of Uruguay..... 21
LaGarde, Dr. Roland—Plants of Czechoslovakia..... 66
Lodewyks, Miss Maude C.—Plants of Missouri..... 9
Lowe, J.—*Calicium polyporaeum* from Michigan..... 1
Overholts, Dr. L. O.—*Hypocraeopsis lichenoides* (Tode ex Fr.) Seaver from Washington..... 1
Perry, Dr. Lily M.—Plants of eastern United States.. 77
Pessin, Dr. L. J.—Fungus from Louisiana..... 1
Pickles, Miss Ella A.—*Physostegia virginiana* Benth from Missouri 1
Stroh, William — *Croton monanthogynus* Michx. from Missouri 1
Teas, Edward—*Osmanthus americanus* (L.) B. & H. from horticulture 1
Tuttle, Mrs. George W.—*Lespedeza Sieboldii* Miq. from horticulture 1
Warner, W. G.—Plants of Missouri..... 5
Whitelaw, Ralph T.—*Hibiscus syriacus* L. "variegatus" from horticulture 1
Wild, Mr. C. M.—*Cocculus carolinus* (L.) DC. from Missouri 1

Total.....1,763

SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date to the death of Mr. Shaw, in 1889, the Garden was maintained under the personal direction of its founder, and, while virtually a private garden, it was, except at certain stated times, always open to the public. Although popularly known as "Shaw's Garden" the name Missouri Botanical Garden was designated by Mr. Shaw as its official title and in his will or in any of his writings he specifically referred to it as the "Missouri Botanical Garden." By a provision of Mr. Shaw's will the Garden passed at his death into the hands of a Board of Trustees. The original members of the Board were designated in the will, and the Board so constituted, exclusive of certain ex-officio members, is self-perpetuating. By a further provision of the will, the immediate direction of the Garden is vested in a Director, appointed by the Board of Trustees. The Garden receives no income from city or state, but is supported entirely from funds left by the founder.

The city Garden comprises 75 acres, where about 12,000 species of plants are growing. There is now in process of development a tract of land of over 1,500 acres outside the city limits which is to be devoted to (1) the propagation and growing of plants, trees, and shrubs, designed for showing either indoors or outside, at the city Garden, thus avoiding the existing difficulties of growing plants in the city atmosphere; (2) gradually establishing an arboretum as well as holding a certain area as a forest reservation, with the idea that possibly at some future time this may become the new botanical garden.

The Garden is open to the public every day in the year, except New Year's Day and Christmas—week days from 8:00 a. m. until one-half hour after sunset; Sundays from 10 a. m. until sunset.

The main entrance to the Garden is located at Tower Grove Avenue and Flora Place, on the Sarah car line (No. 42). Transfer south from all intersecting lines. The Garden may also be reached by Bus Route No. 12, to which all other motor-bus lines transfer.

STAFF
OF THE MISSOURI BOTANICAL GARDEN

THE GARDEN, 2315 TOWER GROVE AVENUE, ST. LOUIS, MISSOURI

GEORGE T. MOORE,
Director

KATHERINE H. LEIGH,
Assistant to the Director

HERMANN VON SCHRENK,
Pathologist

CARROLL W. DODGE,
Mycologist

JESSE M. GREENMAN,
Curator of Herbarium

ROBERT E. WOODSON, JR.,
Research Assistant

ERNEST S. REYNOLDS,
Physiologist

NELL C. HORNER,
Librarian and Editor of Publications

GEORGE H. PRING,
Superintendent

JOHN NOYES,
Consulting Landscape Architect

PAUL A. KOHL,
Floriculturist

WILLIAM F. LANGAN,
Chief Engineer

JOHN H. KELLOGG,
Plant Collector

JOSEPH LANGEN,
Assistant Engineer

AUGUST P. BEILMANN,
Arboriculturist

ARTHUR D. FORRESTER,
Plant Recorder

JOSEPH CUTAK,
In charge of Exotics

ALBERT PEARSON,
Painter

LADISLAUS CUTAK,
In charge of Succulents

THE ARBORETUM, GRAY SUMMIT, MISSOURI

LARS P. JENSEN,
Manager

GUSTAVE GOEDEKE,
Foreman

DAVID MILLER,
Orchid Grower

ROY E. KISSECK,
Engineer

TROPICAL STATION, BALBOA, CANAL ZONE

A. A. HUNTER,
Manager

REPRESENTATIVE IN EUROPE

GURNEY WILSON, F. L. S.
Hove, Sussex, England

Missouri Botanical Garden Bulletin

Vol. XXI NOVEMBER, 1933 No. 9

CONTENTS

Page

An Old, but Newly Discovered Plant for Winter Decoration in the Home 129
Some Interesting Primroses 132
Carrion Flowers 134
The "Dry Sand Treatment" Again 136
Notes 137
Statistical Information 138

ST. LOUIS, MO.
1933

Published Monthly, Except July and August, by the Board of Trustees

SUBSCRIPTION PRICE:

ONE DOLLAR PER YEAR SINGLE COPIES TEN CENTS

BOARD OF TRUSTEES
OF THE MISSOURI BOTANICAL GARDEN

THE ORIGINAL MEMBERS WERE DESIGNATED IN MR. SHAW'S WILL
AND THE BOARD SO CONSTITUTED, EXCLUSIVE OF THE
EX-OFFICIO MEMBERS, IS SELF-PERPETUATING

President
GEORGE C. HITCHCOCK

Vice-President
SAMUEL C. DAVIS

Second Vice-President
DANIEL K. CATLIN

L. RAY CARTER

THOMAS S. MAFFITT

GEORGE T. MOORE

ALBERT T. PERKINS

EUGENE PETTUS

ETHAN A. H. SHEPLEY

FRED G. ZEIBIG

***EX-OFFICIO* MEMBERS**

GEORGE R. THROOP,
Chancellor of Washington University

WILLIAM SCARLETT,
Bishop of the Diocese of Missouri

BERNARD F. DICKMANN,
Mayor of the City of St. Louis

ALBERT KUNTZ,
President of The Academy of Science of St. Louis

DAVID C. TODD
President of the Board of Education of St. Louis

Secretary
GEORGE F. HEFFERNAN

FRUITS OF SOLANUM ACULEATISSIMUM

Missouri Botanical Garden Bulletin

Vol. XXI NOVEMBER, 1933 No. 9

AN OLD, BUT NEWLY DISCOVERED PLANT FOR WINTER DECORATION IN THE HOME

(Solanum aculeatissimum)

This fall there has been brought to the Garden for identification several specimens of a large red-fruited plant with very spiny stems. It proved to be the "many-spined nightshade," *Solanum aculeatissimum,* which has been growing in the economic garden all summer. This plant is beginning to find its way into the trade for use in "winter bouquets," being shipped in to St. Louis from the South, and is supposed to be something new. Although, so far as known, no American seedsman lists it and the only foreign catalogue in which it appears is that of Vilmorin & Andrieux, of France, the plant has been known for a hundred and fifty years and from about 1870 has been recognized as one of the most ornamental members of the Nightshade family. Here we have but another example of plants or flowers having a popular vogue for a time, only to be neglected and forgotten until they are rediscovered and exploited as new.

As early as 1857, E. G. Henderson & Sons, of London, England, listed *Solanum Balbisii,* and this name appeared regularly in both French and English seed catalogues during the sixties. While it is true that in one list *S. ciliatum* is given as a synonym, which is also the name under which *S. aculeatissimum* was at one time known, it is doubtful

whether *S. Balbisii* was the same as *S. aculeatissimum*. Certainly, as at present understood, *S. Balbisii* and *S. aculeatissimum* are two separate and distinct species.

The Nightshade family, to which belong the potato, the tomato, tobacco, belladonna, red pepper, and many other plants of great economic importance, has long been recognized, because of the brilliant fruits produced by some of its members, as suitable for decoration. Probably the best known is the so-called Chinese-lantern plant or bladder cherry, and the Jerusalem cherry is frequently grown as a house plant for its red berries.

In 1786, Jacquin described for the first time a plant from tropical America under the name *Solanum aculeatissimum* which was notable for the size, color, and persistence of its fruits. It was nearly a hundred years later before it certainly appeared in the trade, being introduced as a novelty by Carter & Co., of Holborn, England, probably in the late sixties. They obtained the seed from Porto Rico, and at the time it was said in the English "Gardeners' Chronicle" that, "The great attraction of this species, from a horticultural point of view, will no doubt consist in the exceedingly beautiful berries, which are of a globular shape, depressed at the top, of the size of a Tangierine Orange, and of an intense pure scarlet color, overlaid by a glaucous bloom. Nothing more brilliant can well be imagined." A colored plate of this plant (No. 521), made from material supplied by Messrs. Carter, appeared in the "Floral Magazine," Vol. X, 1871.

In Thomas Meehan's "Gardener's Monthly" for June, 1871, Mr. W. G. Clark, Cleveland, Ohio, wrote:

> "I have a plant of the *Solanum ciliatum* [*aculeatissimum*] raised two years ago from seed, which I believe came from Peter Henderson, which I have bedded out in the summer and taken up and potted and kept in my window through the past two winters. The repotting of course checks it, so that it has to be cut back to get new growth; but I am under the impression that if kept in a pot it would continue to bloom and bear fruit. During the summer it has fruit and flowers at the same time, and all the time until checked by repotting. A valuable feature of the plant is the durability of the fruit, making it very desirable for parlor and Christmas decoration. Scattered among evergreen branches it has a brilliant effect. I have branches on my mantle now with fruit but little shrivelled,

> **which were out in November. To make a handsome bushy plant the ends of the branches should be pinched occasionally."**

The Floral Committee of the Royal Horticultural Society, on November 9, 1915, voted unanimously an award of merit to a specimen of *S. aculeatissimum* "on account of its ornamental fruit." It was exhibited by Messrs. R. F. Fulton, Hanover Square, and was raised from seed of imported fruit from France. "The fruits are much used for decorative purposes in the South of France." Commenting on this award the "Gardeners' Chronicle" for November 20, 1915, said:

> **"This species [*S. aculeatissimum*] is one of a large number of species of shrubby Solanums which are common in the Tropics. . . . It is known to be widely distributed in Tropical America, West Tropical Africa, etc. In a wild state it grows about 2 feet high, has branching stems furnished with straight spines and bristles, ovate-lobed leaves 4 inches long, with spines along the principal nerves on the upper surface. The flowers are star-shaped, white, in axillary cymes. The fruit is globose, smooth, orange-coloured and an inch in diameter. In cultivation the plant grows a yard or more high and the fruits are about 2 inches in diameter. When ripe the skin is thin and parchment-like, and it contains a large number of small flat seeds. The branches are cut and used for decoration in the same way as the Bladder Cherry."**

Accompanying a picture of the fruits of *S. aculeatissimum*, the "Gardeners' Chronicle" of January 17, 1920, has this to say:

> **"Frequenters of Covent Garden Flower Market are aware that some very interesting subjects arrive at various times in wicker baskets or 'pads' among the flowers imported from France. At the present time these exports include pads of *Solanum aculeatissimum*. The stems are stiff, spiny and leafless, but they carry numbers of roundish fruits, dry and firm, not unlike tomato fruits if the latter were hard skinned and dull instead of glossy. The colour is rich vermilion red. Set up in suitable bowls and vases, with contrasting or harmonious foliage, these fruiting growths of *Solanum aculeatissimum* are effective for home decorations, especially during the dull season when flowers are scarce and expensive. Moreover, if kept free from dust the showy fruits last a very long time in a bright and attractive condition. *S. aculeatissimum* is rarely grown in this country, but in the warmer, sunnier south of France it grows freely and ripens its fruits."**

SOME INTERESTING PRIMROSES

Of the evening primroses (Oenothera), only a single species, a native of Tasmania, is indigenous outside of the western hemisphere, although several have been introduced into Europe. It is on the grassy prairies and the arid regions of western United States and Canada that the species are most numerous. They are mostly dry-soil plants, and although a few grow on the sea-coast and in moist soil none are marsh plants.

The Oenotheras are annual, biennial, and perennial herbs, sometimes shrubby at the base. Most of them have yellow flowers, some few have pink, others white. *Oenothera rosea,* a handsome species of Texas and New Mexico, has rose-colored flowers. The known species of the genus number about one hundred. Among our local species the following are the showiest and most interesting:

Missouri Primrose (*Oenothera missouriensis* Sims). — A low perennial plant, with a hard base; stems ascending, about a foot long; leaves linear to narrowly lanceolate, thick, 5 inches or less long; flowers yellow, turning pink in fading, showy, 3-5 inches in diameter, opening in the late afternoon, closing in the morning; seed capsule broadly winged, 2-3 inches long and nearly as wide.

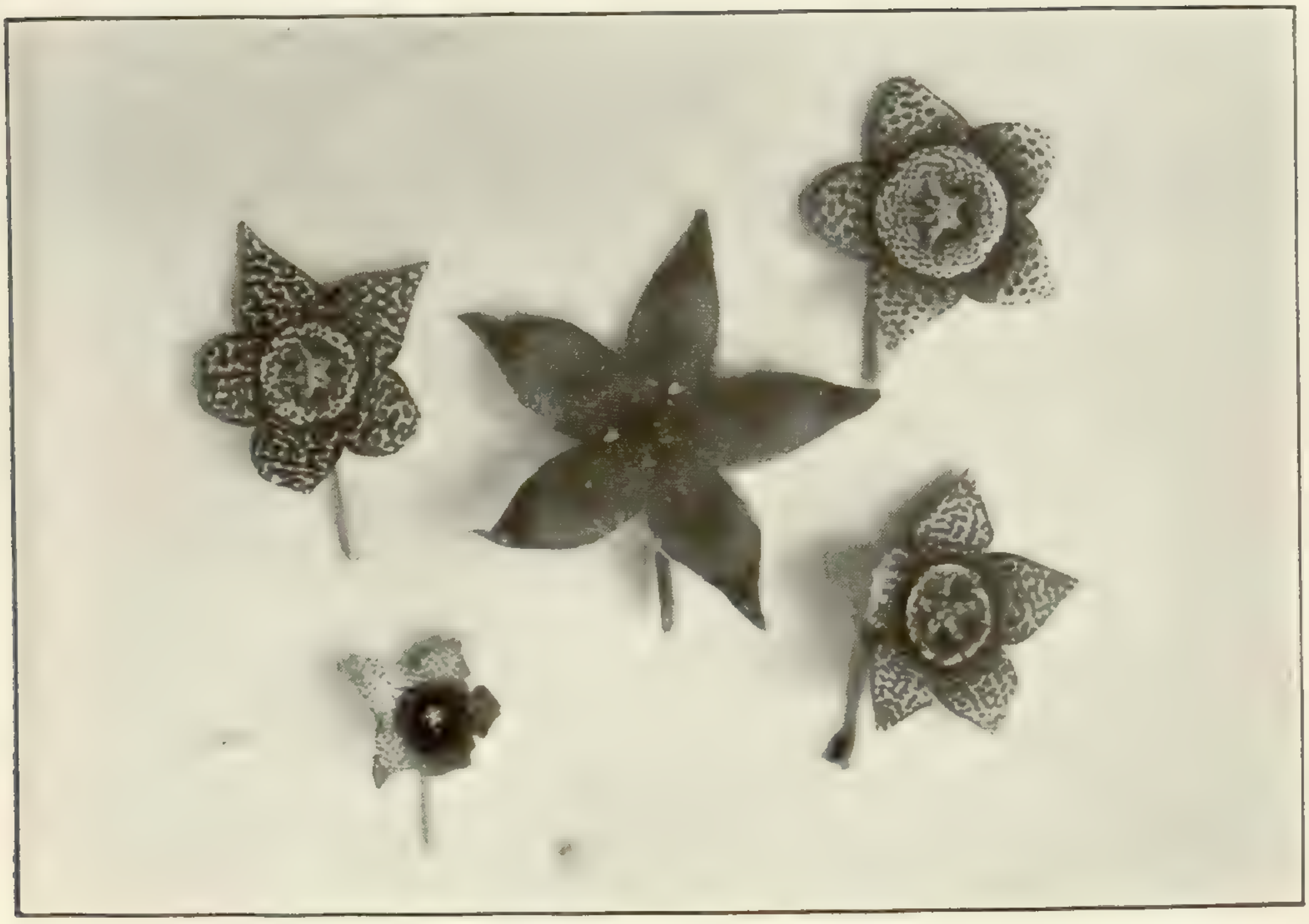
When the seed ripens the capsule opens at the apex and becomes detached from the stem. Then by means of the wings it is propelled by the water or air currents, distributing the seeds as it rolls over the ground. The Missouri primrose is found growing on open limestone glades, forming brilliant patches of bright yellow in late May and early June. It is particularly adapted for the growing in the rock garden, but may also be grown in the border. It is propagated by seeds, which should be sown in the fall.

White Evening Primrose (*Oenothera speciosa* Nutt.).—A perennial of the prairies and plains, 2 feet or less high, with erect or ascending branches; leaves linear to lance-oblong; flowers white, 1½ to 2½ inches broad, the capsule club-shaped, strongly 4-ribbed.

The white evening primrose is very floriferous and showy, starting to bloom in May and continuing over a long period.

MISSOURI PRIMROSE (OENOTHERA MISSOURIENSIS)

WHITE EVENING PRIMROSE (OENOTHERA SPECIOSA)



TYPES OF STAPELIA FLOWERS

STAPELIA GIGANTEA, THE GIANT CARRION FLOWER OF SOUTH AFRICA

It is fine for naturalizing or for planting in the hardy border. As in the Missouri primrose, the flowers last only for a day, but new buds open daily to continue the display. When used as cut flowers for the home, stems with buds in various stages of development should be plucked, so that the bouquet will last for several days. Propagation is by division of the clumps or by seed.

The Common Sundrops (*Oenothera fruticosa* L.) and the Narrow-leaved Sundrops (*Oenothera linearis* Michx.).—These plants, both with spikes of attractive yellow flowers which appear in late summer, are erect, attaining a height of from 1 to 3 feet. They are especially attractive for naturalizing in the wild garden, in dry sunny locations.

The Common Evening Primrose (*Oenothera biennis* L.).—This species, which is commonly found in dry fields and waste places and generally regarded as a weed, is interesting because of its reputed medicinal value. Griffith, in his "Medical Botany," Philadelphia, 1847, writes as follows:

"This species is very common in this country, and is naturalized in Europe. It is exceedingly variable, and numerous species have been indicated on its varieties which do not appear entitled to that rank. When it grows in secluded situations, the leaves become covered with a white mucor, giving them a highly pubescent appearance; and by cultivation the flowers become of much deeper color and of a larger size. They expand in the evening, just at the commencement of twilight, and continue open till the sun begins to exert some power the succeeding morning. The same flower does not expand a second time. Pursh states that he has 'frequently observed a singularity in this plant, and it might be interesting to make further inquiry into its cause; it is that in a dark night, when no objects can be distinguished at an inconsiderable distance, this plant, when in full flower, can be seen at a great distance, having a bright white appearance, which probably may arise from some phosphoric properties of the flowers.'

"*Medical Properties.*—The bark and leaves in a recent state are mucilaginous, and leave a slight sensation of acridity, after being chewed. This latter is not so marked after they have been dried, though the mucilage does not appear to be diminished. Some years since, hearing of the efficacy of the decoction of the plant in infantile eruptions, I made a trial with it in several cases of an obstinate character, which had resisted other modes of treatment, and became satisfied that it was highly beneficial; and this opinion has been confirmed

by subsequent experience with it. The plant is to be gathered about the flowering season, and the small twigs with the bark of the large branches and stem, retaining the leaves with them, to be dried in the shade. Of these a strong decoction is to be made, with which the eruption is to be bathed several times a day. Schoef states that the *O. mollissima*, which is probably the lanescent variety of this plant, is a vulnerary, and in domestic practice, in many parts of the country; the Evening Primrose is a favorite emollient in ulcers."

L. P. J.

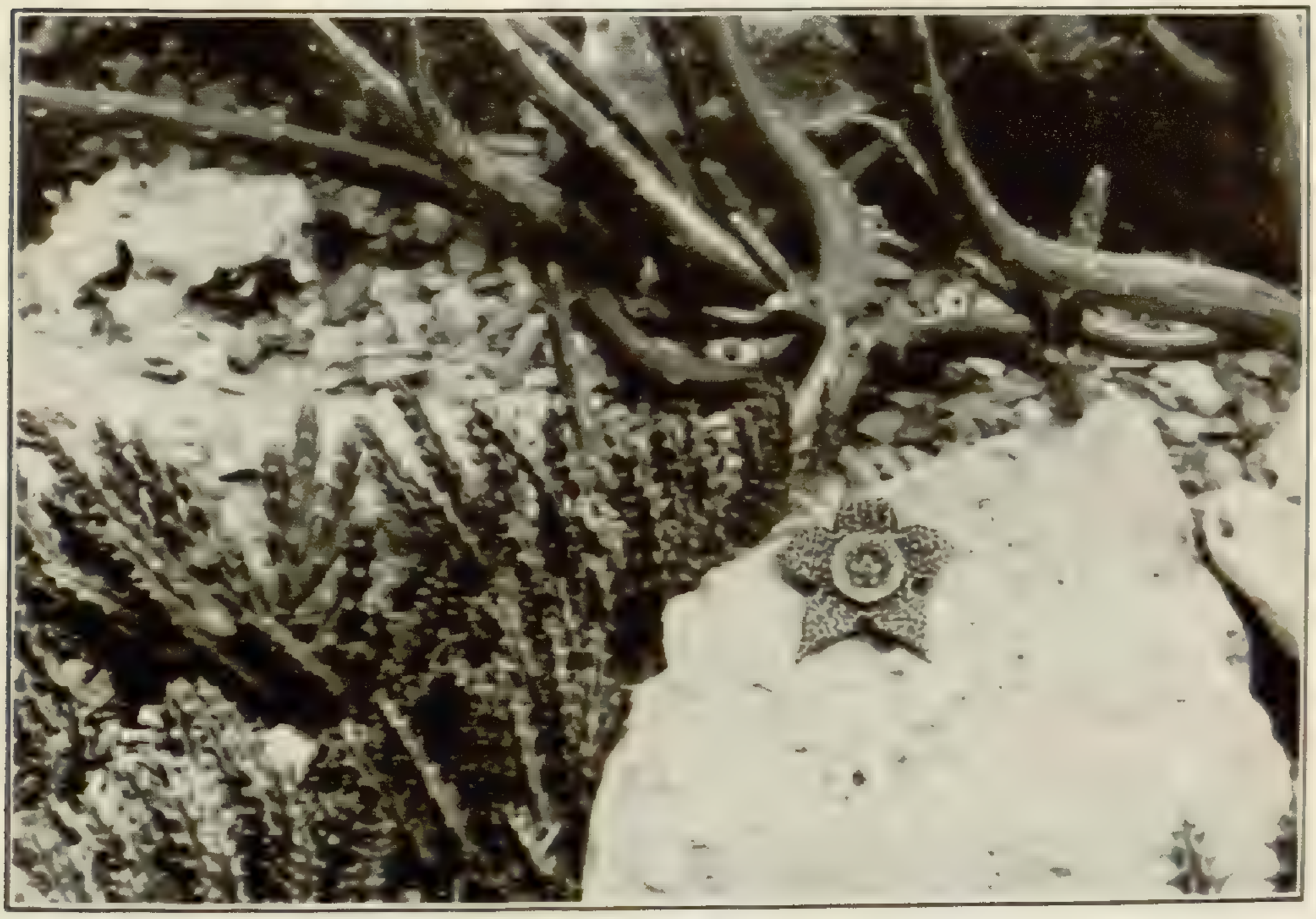
CARRION FLOWERS

Some of the most curious members of the plant kingdom are to be found among the Asclepiadaceae or Milkweed family, native to tropical and South Africa. Stapelia is the largest and oldest genus of the family, and many of the species have been under cultivation in Europe for two or three centuries. The genus is named in honor of J. B. Van Stapel, a Dutch physician of the seventeenth century, who wrote on the plants of Theophrastus. Stapelias are dwarf succulent perennial herbs with thick and fleshy stems branching at the base, and usually 4-angled. They resemble the tall Cereus, those grotesque members of the Cactus family found in deserts and on mountain-sides of our Southwest.

The flowers of the Stapelia are produced annually on well-established plants, in fair profusion from near the base of the stems or scattered along their sides. They bloom from May to December, and this year they have done exceptionally well at the Garden, blooming more profusely in October than at any other period. The flowers are curious and of great variety (pl. 35, fig. 1). Some are large, some of moderate size, and still others only an inch or so across; some are beautifully mottled, others spotted or striped with shades of yellow and brown or red and purple; some are of a leathery texture, others are covered with silky hairs. Some bear a striking resemblance to a starfish, hence one of the popular but erroneous names "Star Cactus" often applied to these plants.

Another peculiarity of the Stapelia flowers is their fetid odor, resembling decaying meat, whence they get the name of carrion flowers. This odor, though faint, is nevertheless

STAPELIAS THRIVING AMONG LIMESTONE
(Notice tall fruiting spike in foreground)



STAPELIA VARIEGATA

A VARIETY OF STAPELIA VARIEGATA

STAPELIA HIRSUTA
(White spots on flower are eggs deposited by blow-flies)

sufficiently strong to attract the blow flies. These flies are deceived by the smell, as they move around the inner surface of the flower, and finally deposit their eggs near the stigma (pl. 37, fig. 1). When the eggs hatch the young grubs can be seen crawling all over the flower in search of food, and in so doing they doubtless carry the pollen from the anthers to the stigma, thereby pollinating the flower. Occasionally visitors, who have watched the flies and not knowing that they really were performing a good deed, have chased them off the flowers.

No lover of succulents should fail to include a few varieties of the carrion flower in his collection, for they are easy of culture. The odor of the flowers should not deter him from acquiring these plants, as it is noticeable only at very close range. All Stapelias propagate very easily from cuttings, and they germinate readily from seed, some blooming within two years from time of planting. They require about the same treatment as cacti—plenty of sunlight, and water freely applied in the summer months but gradually diminished until they are at rest in the winter. They delight in a porous compost of sand, leaf soil, loam, and lime rubble, and the writer has noticed that they do exceedingly well when planted among limestone, as is the case at the Garden (pl. 36, fig. 1). Good drainage is of course necessary, as it is with all succulents.

The oldest and best-known species of the genus is *Stapelia variegata,* which was introduced into cultivation in Holland about 1640. It possesses such great variability in its stems and even more in its flowers (pls. 36, 37) that at least twenty-four varieties are enumerated in the "Flora Capensis."

Stapelia hirsuta (pl. 37, fig. 1) is the next oldest species, having been discovered towards the end of the seventeenth century. The flowers are 3 to 5 inches broad, wrinkled on the inner surface. The flat disk is densely covered with soft purplish hairs, but the lobes are glabrous except for the margins which are covered with coarser, longer, pale purple or white hairs to the very tip. The apical half of the lobes is of a brownish purple color, and the basal half is marked

with transverse creamish lines more or less tinted with purple toward the disk.

The largest-flowered member of the genus is *Stapelia gigantea* (pl. 35, fig. 2), which is shaped like a starfish. The flowers are 12 to 14 inches across, leather-like in texture, the inner surface wrinkled and of a pale yellow color. The entire flower is marked with transverse crimson lines and closely covered with erect, soft, silky hairs. The stems are about the thickness of a thumb, pale green, and 4 to 8 inches long.

It is claimed that some species of Stapelia are eaten by the natives, while others are poisonous and used for medicinal purposes only.

L. C.

THE "DRY SAND TREATMENT" AGAIN

The following communication from Gurney Wilson, Esq., Representative in Europe to the Missouri Botanical Garden, throws an interesting sidelight on the article in the September BULLETIN on preserving flowers. The desirability of preserving, in as natural a condition as possible, successive offsprings of hybrids can well be appreciated by the plant breeder. That the dry sand treatment was used by Crawshay, a pioneer in the hybridization of orchids, affords evidence of the scientific value of the method which might have a wide application.

"Referring to the interesting notes on page 105 of the September issue of the Garden Bulletin, the late Mr. Crawshay, of Sevenoaks, England, made extensive use of dry sand for preserving the flowers of orchids in which he was particularly interested, viz.: Odontoglossum species and hybrids. Single flowers detached without pedicels from an inflorescence were dried in sand for ten or more days and afterwards fixed by means of a pin to a tray in a large cabinet. Additional flowers produced from the same plants during the following years were subsequently affixed, by which method any alteration in their size or quality, brought about by different cultural treatment in any particular season. was made apparent.

"The cabinet containing many hundreds of dried Odontoglossum flowers at first sight resembled an entomological collection, but closer inspection revealed the fact that on the dry petals of each flower Mr. Crawshay had recorded in ink the

date of its production as well as an index number to the plant's history in his record books.

"At a period when comparatively little was known concerning natural hybrids, and artificial hybrids were few and far between, Mr. Crawshay fixed a flower of *Odontoglossum crispum* at one end of a tray and one of *O. luteopurpureum* at the other end. In course of time he filled the intervening space with a series of flowers, each successive example differing slightly from its neighbour, while the whole line of flowers showed a gradual gradation in character from that of *O. crispum* to that of *O. luteopurpureum*.

"Mr. Crawshay was thus able to demonstrate that the majority of the blotched varieties of *O. crispum*, which then realised high figures, were not of pure descent, but were in fact natural hybrids between this species and *O. luteopurpureum*, and should be classified as *O.* × *Wilckeanum*. He also carried out similar schemes with respect to other species and hybrids."

NOTES

Mr. L. P. Jensen, Manager Missouri Botanical Garden Arboretum, gave an illustrated talk before the members of the St. Louis Horticultural Society, November 3, on "Highway Beautification."

Mr. G. H. Pring, Superintendent of the Garden, spoke before the "Indian Guides" of the St. Louis Y. M. C. A., November 1, on "Orchid Exploration"; and before the Ladies Florists' Club of St. Louis, at the Hotel Kingsway, November 6, on "The Value of Orchids in Floral Design."

Recent visitors to the Garden include Mr. Fritz Leissler, Landscape Gardener of the Seattle Park Department; Dr. E. R. Spencer, professor of botany, McKendree College, Lebanon, Ill.; and Mr. J. M. Kuroski, a former U. S. vocational student at the Garden, now a florist at Quogue, Long Island, N. Y.

The article from the February BULLETIN, by Mr. Ladislaus Cutak, in charge of succulents at the Garden, on "Growing Succulents from Seed in the Home," was reprinted in "Garden Digest" for October, and Dr. David C. Fairburn's article from the September BULLETIN, "Dry Sand Treatment for Preserving Flowers," has been copied in the November number of "Horticulture" and "Garden Digest," and the "St. Louis Post-Dispatch," November 9.

STATISTICAL INFORMATION FOR OCTOBER, 1933

GARDEN ATTENDANCE:

Total number of visitors.....27,894

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought.....	12
Total number of books and pamphlets donated.....	125

PLANT ACCESSIONS:

Total number of plants and seed packets donated.....	147

HERBARIUM ACCESSIONS:

By Purchase—

Bush, B. F.—Plants of Missouri and Kansas.....	207
Lundell, C. A.—Plants of British Honduras.....	85

By Exchange—

California Academy of Sciences by John Thomas Howell —Plants of California.....	40
Hitchcock, Dr. C. L.—Plants of Montana.....	10
Shimek, Professor B.—Plants of Iowa.....	71
Universitas Asiae Mediae—"Florae Asiae Mediae," Fasc. I-XX, Nos. 1-500, inclusive.....	500
University of Michigan by William C. Steere—Plants of Yucatan	32

By Gift—

Bush, B. F.—Plants of Ontario.....	6
Eunis, Miss Beulah—*Eriogonum annuum* Nutt. from Oklahoma	1
Fuller, Dr. Harry J.—*Ocimum Basilicum* L. (introduced)	1
Hanna, Leo A.—Plants of Colorado.....	2
Hugo, Mrs. W. C.—*Clerodendron foetidum* Bunge of horticulture	1
Kelly, Mrs. J.—*Boussingaultia baselloides* HBK. of horticulture	1
Meek, L. E.—*Prenanthes altissima* L. var. *cinnamomea* Fern. from Indiana.....	1
Steyermark, Dr. Julian A.—Plants of California and Texas	20
Steyermark, Dr. Julian A.—Plants of Missouri.....	2
Train, Percy, by Dr. William R. Maxon—Lichens of Oregon	40
von Schrenk, Dr. Hermann—*Taxodium ascendens* Brogn. from Alabama	1
Wild, C. M.—*Poinciana Gilliesii* Hook. of horticulture.	1
Williams, Louis—*Miltitzia* sp. from Colorado.....	1
Total	**1,023**

SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date to the death of Mr. Shaw, in 1889, the Garden was maintained under the personal direction of its founder, and, while virtually a private garden, it was, except at certain stated times, always open to the public. Although popularly known as "Shaw's Garden" the name Missouri Botanical Garden was designated by Mr. Shaw as its official title and in his will or in any of his writings he specifically referred to it as the "Missouri Botanical Garden." By a provision of Mr. Shaw's will the Garden passed at his death into the hands of a Board of Trustees. The original members of the Board were designated in the will, and the Board so constituted, exclusive of certain ex-officio members, is self-perpetuating. By a further provision of the will, the immediate direction of the Garden is vested in a Director, appointed by the Board of Trustees. The Garden receives no income from city or state, but is supported entirely from funds left by the founder.

The city Garden comprises 75 acres, where about 12,000 species of plants are growing. There is now in process of development a tract of land of over 1,500 acres outside the city limits which is to be devoted to (1) the propagation and growing of plants, trees, and shrubs, designed for showing either indoors or outside, at the city Garden, thus avoiding the existing difficulties of growing plants in the city atmosphere; (2) gradually establishing an arboretum as well as holding a certain area as a forest reservation, with the idea that possibly at some future time this may become the new botanical garden.

The Garden is open to the public every day in the year, except New Year's Day and Christmas—week days from 8:00 a. m. until one-half hour after sunset; Sundays from 10 a. m. until sunset.

The main entrance to the Garden is located at Tower Grove Avenue and Flora Place, on the Sarah car line (No. 42). Transfer south from all intersecting lines. The Garden may also be reached by Bus Route No. 12, to which all other motor-bus lines transfer.

STAFF
OF THE MISSOURI BOTANICAL GARDEN

THE GARDEN, 2315 TOWER GROVE AVENUE, ST. LOUIS, MISSOURI

GEORGE T. MOORE,
Director

KATHERINE H. LEIGH,
Assistant to the Director

HERMANN VON SCHRENK,
Pathologist

CARROLL W. DODGE,
Mycologist

JESSE M. GREENMAN,
Curator of Herbarium

ROBERT E. WOODSON, JR.,
Research Assistant

ERNEST S. REYNOLDS,
Physiologist

NELL C. HORNER,
Librarian and Editor of Publications

GEORGE H. PRING,
Superintendent

JOHN NOYES,
Consulting Landscape Architect

PAUL A. KOHL,
Floriculturist

WILLIAM F. LANGAN,
Chief Engineer

JOHN H. KELLOGG,
Plant Collector

JOSEPH LANGEN,
Assistant Engineer

AUGUST P. BEILMANN,
Arboriculturist

ARTHUR D. FORRESTER,
Plant Recorder

JOSEPH CUTAK,
In charge of Exotics

ALBERT PEARSON,
Painter

LADISLAUS CUTAK,
In charge of Succulents

THE ARBORETUM, GRAY SUMMIT, MISSOURI

LARS P. JENSEN,
Manager

GUSTAVE GOEDEKE,
Foreman

DAVID MILLER,
Orchid Grower

ROY E. KISSECK,
Engineer

TROPICAL STATION, BALBOA, CANAL ZONE

A. A. HUNTER,
Manager

REPRESENTATIVE IN EUROPE

GURNEY WILSON, F. L. S.
Hove, Sussex, England

MISSOURI BOTANICAL GARDEN BULLETIN

Vol. XXI DECEMBER, 1933 No. 10

CONTENTS

	Page
Remarkable Aerial Roots of a Tropical Grape Vine	139
Prickly Pear in Fruit	141
Dendrobium superbiens, a Natural Hybrid (*D. Phalaenopsis* X *D. undulatum*)	142
Winter Courses in Gardening for Amateurs	144
Notes	147
Statistical Information	149
Index to Illustrations of Volume XXI	151
General Index to Volume XXI	153

ST. LOUIS, MO.
1933

Published Monthly, Except July and August, by the Board of Trustees

SUBSCRIPTION PRICE:

ONE DOLLAR PER YEAR SINGLE COPIES TEN CENTS

BOARD OF TRUSTEES
OF THE MISSOURI BOTANICAL GARDEN

THE ORIGINAL MEMBERS WERE DESIGNATED IN MR. SHAW'S WILL
AND THE BOARD SO CONSTITUTED, EXCLUSIVE OF THE
EX-OFFICIO MEMBERS, IS SELF-PERPETUATING

President
GEORGE C. HITCHCOCK

Vice-President
SAMUEL C. DAVIS

Second Vice-President
DANIEL K. CATLIN

L. RAY CARTER

ALBERT T. PERKINS

THOMAS S. MAFFITT

EUGENE PETTUS

GEORGE T. MOORE

ETHAN A. H. SHEPLEY

FRED G. ZEIBIG

EX-OFFICIO MEMBERS

GEORGE R. THROOP,
Chancellor of Washington University

BERNARD F. DICKMANN,
Mayor of the City of St. Louis

WILLIAM SCARLETT,
Bishop of the Diocese of Missouri

ALBERT KUNTZ,
President of The Academy of Science of St. Louis

DAVID C. TODD
President of the Board of Education of St. Louis

Secretary
GEORGE F. HEFFERNAN

1 2

STILT PLANT (PANDANUS SANDERAE)

1. Specimen growing in greenhouse at Garden. 2. Root cap.

Missouri Botanical Garden Bulletin

Vol. XXI DECEMBER, 1933 No. 10

REMARKABLE AERIAL ROOTS OF A TROPICAL GRAPE VINE

While most plants have roots below the surface of the ground, a few kinds, such as the epiphytic orchids, produce their entire root system above the ground. Moreover, under certain circumstances, plants with normally underground root systems will develop roots on stems above the ground. The prop-roots of the corn plant are produced from the stem close to the ground, and serve to brace the plant. Through the development of aerial prop-roots from its extensive branches, a single banyan tree is able to create the impression of being a forest in itself. Conspicuous on the end of the prop-roots of the stilt plant *(Pandanus Sanderae)* is a relatively enormous corky root cap (pl. 38). Short aerial roots are developed by the stems of many climbing plants. Poison ivy owes its clinging ability to aerial roots produced by the stem, and some of the vines of the Aroid family reach the heights in tropical jungles by short aerial roots which cling steadfastly to the nearest limb.

When a vigorous climbing grape vine equipped with a twining stem and excellent tendrils develops aerial roots—that's news. Interesting news, for the roots are not short, they do not help the plant in its climb upward, nor do they anchor the plant or support it. Instead they weight it down. Possibly the only function of these roots is to provide more efficient short cuts for the transportation of water from the

ground to the younger and more active portions of the stem. Such a tropical grape vine was received at the Garden under an unpublished name. It produces long aerial roots in abundance, and since being planted in the cycad house five years ago, the vines have climbed the wires specially stretched to the roof girders. Here it festoons itself luxuriantly along the beams of the greenhouse, and hanging down are the multitudinous string-like aerial roots that soften and mellow the vistas through the ferns (pl. 39).

An aerial root is produced in the axil of each leaf. This grows downward, swinging freely, sometimes attaining a length of forty feet before it touches the ground. Under normal circumstances the roots do not produce branches until they reach the soil, and then they begin to branch abundantly underground. However, they may be induced to produce branches. Injury to the tip of the young root effects the development of several branch roots at a point about half an inch above the injury. Older roots may be caused to branch by cutting through the stem. One example of branching was seen in which a root 3/16 of an inch in diameter had given rise to two branch roots each equal in size to the parent root.

The roots may be seen in all stages of development. The small roots are reddish in color and about 1/16 of an inch in diameter, but long before reaching the ground they begin to increase in diameter. At the present time, the older roots are about ¼ of an inch in diameter. Since the older roots are greenish in color underneath the thin brown papery bark, it is quite likely that they aid in food manufacture. The gardeners have noticed with glee that they do not develop leaves or shoots when they strike the soil. If they did, the vine would be a terrible greenhouse weed.

A preliminary examination shows that the internal structure of the small roots is just like any other small root. The thickening is accomplished chiefly through the addition of more wood. Large water-conducting vessels may be seen on examining a cross-section. Quite unusual is the conspicuous pith present in the center, most roots not having a pith.

JOHN ADAM MOORE.

ROOTS OF TROPICAL GRAPE VINE GROWING IN CYCAD HOUSE

PRICKLY PEAR GROWING AT THE GARDEN ARBORETUM

PRICKLY PEAR IN FRUIT

The prickly pear is by far the most widely distributed cactus in the United States and also probably the most variable. Although indigenous to America, as all cacti are, it now grows in many parts of the world and has long been established in the mountains of Italy and Switzerland.

Opuntia Rafinesquii (Opuntia Opuntia Coult.) is a wide-spreading prostrate plant with deep green, rather large, orbicular to obovate joints, areoles about an inch apart and filled with reddish-brown glochids. Spines sometimes are wanting, but in the Missouri species there is usually one from an areole and then mostly on the upper part or along the margin of the joint, rather stout, white, with yellowish-brown or darker tips and bases. The flowers are of a sulphur-yellow color and usually with red centers. The fruit is slenderly club-shaped, red, about 2 inches long, fleshy, edible, and somewhat sweet. As the top is a shallow, funnel-shaped umbilicus much wrinkled and scarred. The pulp is purplish, and each pear contains from 25 to 30 comparatively large seeds. The flowering period lasts throughout May, sometimes June and even July, and the fruit ripens in the same season but remains on the plant till the following spring. Occasionally the joints are purple-tinted around the areoles.

The prickly pear presents many variations doubtless caused by environment. It thrives in sandstone and limestone regions as well as in sterile and fertile soils, in open glades, and even in well-timbered sections where some of the joints elongate under shade conditions.

In early November the writer made a trip to the Garden Arboretum, at Gray Summit, where he found the prickly pear in fruit. The accompanying photograph (pl. 40) shows the plant in its natural environment, growing alongside *Chenopodium ambrosioides,* the medicinal weed naturalized from tropical America and commonly known as "wormseed."

Opuntia Rafinesquii, the western form which is so abundantly found in Missouri, and *Opuntia vulgaris,* the eastern form found along the Atlantic coast, are considered identical by many botanists and as synonyms of *Opuntia Opuntia* in the "Cactaceae" of Britton and Rose. L. C.

DENDROBIUM SUPERBIENS, A NATURAL HYBRID

(D. PHALAENOPSIS X D. UNDULATUM)

In the February, 1932, number of the "Orchid Review," page 34, appeared the following note:

> *Dendrobium Pauline.*—A very decorative hybrid has been raised by Messrs. Stuart Low & Co. and recorded as Dendrobium Pauline (Phalaenopsis var. Schroederianum x undulatum). The seedling was removed from the culture flask in July, 1929, when only a few weeks old, and subsequently made such rapid progress that in January of the present year, when about thirty months old, it had attained a height of 11 inches and carried a graceful spike of eleven flowers. In its habit of growth the plant closely resembles D. undulatum, as also do the flowers in the twisted state of the sepals, and, in a less degree, of the petals. The individual flowers, when fully expanded, measure three inches across; the sepals and petals are of a deep-rose colour shaded and reticulated with magenta-purple; the sepals are whitish on the back and have a narrow pale rose margin; the labellum is magenta-purple and has a five-keeled crest that displays this colour in more intense form. No other garden-raised hybrid of D. undulatum seems to have been recorded, but the plant described in 1884 as D. Fitzgeraldii is believed to be a natural hybrid between D. superbiens and D. undulatum, both natives of northern Australia.

In the April number of the same volume, p. 100, Mr. Pring, Superintendent of the Garden, commented on the above, as follows:

> In perusing the February issue of the *Orchid Review*, I read with interest the descriptive note, page 34, on Dendrobium Pauline (phalaenopsis x undulatum), which flowered with Messrs. Stuart Low & Co. during the month of January.
>
> During my visit in 1928 to our Tropical Station, Canal Zone, Panama, I was much impressed with the possibility of crossing Dendrobium undulatum with D. phalaenopsis, since the former plant is a prolific grower and not at all shy in flowering, so I brought back a good plant to the Missouri Botanical Garden, St. Louis, for that purpose.
>
> On August 24th, Mr. I'Anson, of Greystone, Yonkers, N. Y., sent seeds of D. undulatum x D. phalaenopsis to the Garden for germination, and as it was not for commercial use, the Director granted permission. Mrs. Linder's seedling book records: "Eighty per cent. seeds fertile. First sowing, August 24th, 1928, seven flasks. Second sowing, November 1st, 1928."

DENDROBIUM SUPERBIENS RAISED AT THE GARDEN
(Seeds sown November 1, 1928; photograph taken November 1, 1933.
The plant is 2½ feet high).

1. FORMS OF DENDROBIUM PHALAENOPSIS FLOWERS GROWN FROM SEED. 2. FLOWER OF HYBRID RAISED AT THE GARDEN. 3. FORMS OF D. SUPERBIENS FLOWERS. 2 AND 3 SHOW PALE ROSE MARGINS CHARACTERISTIC OF D. SUPERBIENS.

In July, 1931, half of the young plants were sent to Mr. I'Anson, who flowered one of his plants during October, 1931. On November 23rd, two flowers were sent which closely check with the description given in the *Orchid Review*. Mr. I'Anson proposed the name Dendrobium Greystone, which Dr. Moore, the Director, agreed to. It certainly is interesting to me that there should be a triangle thought regarding the same cross —Panama, United States, and England, for these Australian species about the same time. However, the St. Louis plant seems to be one jump ahead of D. Pauline.

In the August number, page 246, Mr. Leaney continued the discussion:

> Considerable attention has recently been given to Dendrobium Pauline (phalaenopsis x undulatum), for two gentlemen have discussed the plant at some length in the *Orchid Review*, pp. 34 and 100.
>
> It is my personal opinion that neither of these gentlemen has the honour of first crossing these two species; in my mind we have Nature to thank for the result of this cross, and most probably it occurred thousands of years ago.
>
> I have discovered D. Pauline in the form of a natural hybrid growing amongst large quantities of both parents, and in places that in the past have been simply covered with D. phalaenopsis and D. undulatum. The hybrid does not appear to have been given any botanical name, probably on account of its botanical rarity, but there are several local nicknames for it.
>
> The fact that this plant grows in fairly large colonies, but only in very few places and not scattered over districts, lends colour to my suggestion that it is a natural hybrid. My best description of the flowers and habit is intermediate between the two alleged parents. If anything the flowers resemble those of D. undulatum a little more than those of D. phalaenopsis. I am sure from the description of D. Pauline that this plant is identical with the one described.
>
> Should any reader be interested enough to write me, I would be pleased to forward a photograph of the plant.
>
> R. F. LEANEY.
>
> Chatswood, Sydney, N. S. W., Australia.

Since Mr. R. F. Leaney, of Chatswood, Sydney, Australia, drew attention to the fact that *Dendrobium* "Pauline" or "Greystone" grows in association with *D. Phalaenopsis* and *D. undulatum,* the writer has had the opportunity of studying the flowering seedlings of *D. superbiens* at the Garden.

During October, 1932, two of our seedlings flowered which undoubtedly show characteristics of *D. Phalaenopsis* and *D. undulatum* (pl. 41). At the present time three more seedlings are in bloom, as well as several plants which have been in the Garden collection for fifteen years, having been imported in a shipment of *D. Phalaenopsis*. The pseudobulbs were identical in shape, and there was no way of knowing that two kinds of plants were included. It was therefore a surprise to find *D. superbiens* the following flowering season, especially as the described species have growth typical of *D. undulatum* and not of *Phalaenopsis*. The Garden-raised hybrids may readily be distinguished from *D. Phalaenopsis* but not from *D. undulatum*. During the seedling stages the growth resembled *D. Phalaenopsis*, but later it showed the elongated fusiform pseudobulbs characteristic of *D. undulatum*. The flowers also are typical *undulatum* except for the mauve color. The pale rose margins of the sepals and petals described for *D. superbiens* is likewise shown in the hybrid seedlings. Since both imported plants and the hybrid seedlings grown at the Garden are identical, *D. superbiens* should be recognized as a natural hybrid and not a species.

The writer is firmly convinced that *D. bigibbum* is likewise a natural hybrid from the same parentage, possibly the reciprocal cross favoring the *Phalaenopsis* parentage or possibly a F_2 generation. The hybrid has been selfed for further study.

There is quite a difference in size and color of imported *D. Phalaenopsis*, the color ranging from white to dark mauve. This variation is also shown in plants raised at the Garden (pl. 42).

G. H. P.

WINTER COURSES IN GARDENING FOR AMATEURS

ELEMENTARY COURSE

The elementary course in various phases of gardening for amateurs, which has been conducted at the Garden for the past few years, will be repeated in 1934. As formerly, it will commence in January, since it is believed that the course is of more value when given earlier in the year. The class will meet in the lecture room of the museum building (en-

trance at Tower Grove and Cleveland Avenue gate) at 3:45 p. m., Tuesday afternoons of each week.

REGISTRATION: It is desirable that registration be made by letter, with check payable to the Missouri Botanical Garden enclosed, as soon after December 20 as possible. Tickets will be ready for distribution on day of first lecture. Registration fees will also be received on January 9 at the lecture hall, at three o'clock.

FEES: The registration fee is $5.00 for each person, and tickets are not transferable.

The outline of the subjects to be discussed follows:

January 9—Brief discussion of catalogues, horticultural magazines, and bulletins. Illustrated lecture and instruction on rock gardens and wall gardens. The use of hot-beds and cold-frames.....Kohl

January 16—Trees and shrubs:
Pruning of shrubs at planting time.
Summer and winter pruning of trees and shrubs with relation to the time of bloom, i. e., trees and shrubs flowering in spring from buds formed the previous season; those blooming in summer on wood made during the current season .....Beilmann

January 23—Practical demonstration (students participating) in growing plants from seeds and cuttings.....Fairburn

January 30—General care of trees; the importance of tree surgery and the use of fertilizers.....Beilmann

February 6—Roses. Illustrated lecture.....Kohl

February 13—Lawns:
Seed lawns: Preparation of the soil, seed selection, fertilizers.
Stolon lawns: Methods of planting by means of stolons and plugging.
Lawns and their subsequent care.
Experimental lawn plots.....Pring

February 20—Transplanting seedlings grown from the seed sown on January 23.....Fairburn

February 27—Controlling insect pests. Material to use..Beilmann

March 6—Water gardens. Illustrated lecture.
Construction of pools.
Preparation of soil and planting.
Caring for hardy and tropical water-lilies during growing season.

Propagation by seeds, tubers, leaves.
Breeding.
Winter storage.....Pring

March 13—Demonstration in pruning and spraying, including use of power and hand sprayers and dusters.....Beilmann

March 20—Practical demonstration in the greenhouse of potting seedlings, cuttings, and larger plants.
Preparation of soil for sowing seed outdoors.....Fairburn

March 27—Annuals, perennials. Illustrated lecture.....Kohl

April 3—Iris, peonies, and bulbs. Illustrated lecture.....Kohl

ADVANCED COURSE

In response to many urgent requests, an advanced course in gardening for amateurs, designed to supplement the elementary garden course, will be given at the Garden, starting January 11, 1934. This advanced study will consist mainly of practical laboratory work in the greenhouse, under the direction of Dr. Fairburn. The class will assemble in the lecture room of the Museum building at 10 A. M. Thursday of each week.

REGISTRATION: Limited to 20 students and open only to those who have already taken the elementary course in gardening.

FEES: The registration fee is $5.00 per person and tickets are not transferable. Write or phone the Garden for reservations.

January 11—The nature of the plant:
A study of roots, stems, leaves, buds, flowers, fruits and seeds. Specimen demonstration in the greenhouse.

January 18—Soils and their improvement:
Chemical, physical, and biological relationships of soil. Preparation of fertile garden loam. The use of fertilizers. Greenhouse practice.

January 25—Plant propagation:
Seed, cuttings, division, and grafting. Greenhouse practice.

February 1—Garden maintenance:
Planting, watering, cultivating, weeding, pruning, staking, mulching, and winter protection.

February 8—Insects and diseases:
Identification and control of common garden pests. Greenhouse practice.

February 15—Planning the flower garden:
Study of seed and nursery catalogues. Each student will prepare an outline for a flower border and make up a sample order sheet for the plants needed.

February 22—Potting seedlings and cuttings:
Greenhouse practice.

March 1—Types of gardens:
Arrangement and planting of various types of gardens.

March 8—Landscaping the home grounds:
Basic principles of landscape design with a survey of plant materials.

March 15—House plants:
Flowering and foliage plants adapted for home culture. Specimen demonstration in the greenhouse.

March 22—Question box and general discussion.

NOTES

Dr. D. C. Fairburn gave an illustrated lecture before the St. Louis Horticultural Society, December 1, on "The Gladiolus."

Dr. George T. Moore, Director of the Garden, spoke before the Sorosis Club of Greenville, Ohio, December 7, on "Some Inside Facts About Trees," illustrated with moving pictures.

Mr. August P. Beilmann, Arboriculturist to the Missouri Botanical Garden, spoke at a meeting of the Art Section of the Wednesday Club, December 13, on "Unusual Flowers of Our Native Trees."

Dr. Mildred E. Mathias, Research Associate, New York Botanical Garden, and Dr. Harry J. Fuller, Instructor in Botany, University of Illinois, visited the Garden library recently.

Mr. G. H. Pring spoke before the Midland Valley Garden Club, November 21, on "Gardening as a Hobby"; before a meeting of the Rose Hill Lodge, November 28, on "Orchid Exploration in the Andes of Colombia"; before the Osage Garden Club, December 1, on "Winter Protection in the Garden."

Mr. L. P. Jensen, Manager Missouri Botanical Garden Arboretum, spoke before Watson-Antire Regionway Im-

provement Association, at Valley Park, November 22, on "Roadside Planting and Improvement"; and before the Garden Club of Gray Summit, December 4, on "The History of Landscape Gardening."

Members of the Garden Clubs of Missouri held a meeting in the lecture room of the Garden, November 23, to organize the Missouri Federation of Garden Clubs. An address was given by Mr. G. H. Pring, on "The Evolution of the Chrysanthemum," after which a tour of the Garden and Chrysanthemum Show was made.

The fourth number of Volume XX of the Annals of the Missouri Botanical Garden has been issued and contains the following papers: "Sources of Carbohydrate for Germination and Growth of Orchid Seedlings," F. Lyle Wynd; "Super Optimal and Thermal Death Temperatures of the Cotton Plant as Affected by Variations in Relative Humidity," Dorothy Megowen Berkley and Earl E. Berkley; "Studies in the Apocynaceae, IV. The American Genera of Echitoideae," Robert E. Woodson, Jr.; "Report of a Botanical Expedition into the Mountains of Western Texas," Julian A. Steyermark and John Adam Moore.

STATISTICAL INFORMATION FOR NOVEMBER, 1933

GARDEN ATTENDANCE:

Total number of visitors.....66,678

LIBRARY ACCESSIONS:

Total number of books and pamphlets bought.....	17
Total number of books and pamphlets donated.....	30

PLANT ACCESSIONS:

Total number of seed packets donated.....	55
Total number of bulbs donated.....	250

HERBARIUM ACCESSIONS:

By Purchase—

Bush, B. F.—Plants of Missouri and Kansas.....	263
Killip, Ellsworth P.—Plants of Peru collected by G. Klug.....	484
Stewart, Dr. Ralph R.—Plants of India.....	700
Thompson, J. William—Plants of Washington.....	750
Williams, Louis—Plants of Wyoming.....	352

By Exchange—

Demaree, Professor Delzie—Plants of California.....	258
Drushel, Professor J. A.—Plants of Vermont, New York, New Jersey, Texas, etc.....	145
Gray Herbarium, Harvard University—Plants of Costa Rica, collected by Dr. C. W. Dodge.....	18
Thompson, J. William—Plants of Washington.....	108
U. S. National Museum—Plants chiefly of Tropical America and Asia.....	76
University of Iowa—Fungi of Iowa.....	13
University of Michigan by William C. Steere.....	4

By Gift—

Conzatti, Professor C.—Plants of Mexico.....	116
Cota, F. M.—Lichens of southern California and Lower California	57
Deam, Charles C.—Plants of Indiana.....	15
Kellogg, John Henry—Plants of Missouri, collected by B. F. Bush.....	50

Killip, Ellsworth P.—Plants of Peru, collected by G. Klug 22
Leeds, Arthur N. — *Ilex Amelanchier* Curtis from Georgia 1
Purer, Dr. Edith A.—Plants of California 110
Stevenson, John A.—Coleosporiums 184
Steyermark, Dr. Julian A.—Grindelias of California .. 4
Steyermark, Dr. Julian A. — *Grindelia oolepis* Blake from Texas 1
Steyermark, Dr. Julian A.—Plants of Missouri 3
Von Schrenk, Dr. Hermann—*Taxodium* from the southern states and Mexico 5
Total 3,739

Index to Illustrations

PAGE

Henry Shaw Medal..... 1
1932 Chrysanthemum Show, view of..... 8
Japanese tea house, a feature of the 1932 Chrysanthemum Show 9
Orchids, bouquet of, presented to the Queen of the Veiled Prophet in 1932..... 14
Vanda Sanderiana from the Dwight F. Davis orchid collection. 15
X *Crinodonna Corsii*..... 37
Tithonia speciosa exhibited at the St. Louis Horticultural Society Flower Show; plants grown by Mr. John W. Cook of Webster Groves, Mo..... 40
Succulents, seedlings of..... 41
Titanopsis Schwantesi and *T. calcarea*..... 41
Conophytum Luisae, Rimaria Heathii, Hereroa granulata, Cheiridiopsis peculiaris and *Rimaria Heathii*..... 42
Nymphaea kewensis, kept dormant in sand for four years; same tubers after being kept in the propagating tank for three weeks..... 49
"Derailment of train by cucumbers"..... 56
"Fight in a Wheat Field near St. Louis"..... 56
"The Canoe Liana in the Wilds near St. Louis"..... 57
"Rhubarb House at the World's Fair in St. Louis"..... 57
Cross-section of Tree No. 9, showing nearly circular growth.. 61
Longitudinal Section of Tree No. 9, showing extent of decay... 61
Treated cuts on trees..... 62
Untreated cuts on trees..... 63
Desert scene, miniature, displayed at the Garden..... 81
Cacti in the home..... 82
Xanthoceras sorbifolia, terminal racemes of white flowers..... 83
Xanthoceras, new shoots of, four weeks after cuttings were made..... 83
Xanthoceras, rooted cutting of, eight weeks old..... 84
Xanthoceras, method of placing a single cutting in a pot..... 84
Cirrhopetalum Medusae..... 95
Ceropegia Woodii, Ceropegia Sandersonii, Ceropegia stapeliaeformis..... 96
Pseudobulbs of *Schomburgkia tibicinis* and of *Diacrium bicornutum*, showing openings for ants..... 97

PAGE

Bulbophyllum barbigerum..... 97
Bulbophyllum Dayanum and *B. Lobbii*..... 98
Diacrium bicornutum and *Schomburgkia tibicinis*..... 99
A killdeer in the Garden.....100
Dry sand treatment for preserving flowers.....105
Watering cacti from below.....108
Albizzia Julibrissin, flower cluster and fruit of.....109
Grammatophyllum multiflorum.....110
Dendrobium Phalaenopsis var. *Schroederianum*. Parent plant and three seedlings.....115
Pterocarya Rehderiana, branch of, showing mature seed.....120
Pterocarya Rehderiana (wing-nut) growing in the Missouri Botanical Garden.....121
Solanum aculeatissimum, fruits of.....129
Missouri primrose *(Oenothera missouriensis)*, and white evening primrose *(Oenothera speciosa)*.....132
Stapelia flowers, types of.....133
Stapelia gigantea, the giant carrion flower of South Africa....133
Stapelias thriving among limestone.....134
Stapelia variegata.....134
Stapelia hirsuta.....135
Stapelia variegata, a variety of.....135
Stilt plant *(Pandanus Sanderae)*; root cap.....139
Roots of tropical grape vine growing in Cycad House.....140
Prickly pear growing at the Garden Arboretum.....141
Dendrobium superbiens raised at the Garden.....142
1. *Dendrobium Phalaenopsis* flowers, forms of; 2. flower of hybrid raised at Garden; 3. *D. superbiens* flowers, forms of..143

General Index

Figures in italics refer to page numbers of plates and cuts.

A

Acer saccharinum, pruning experiments with, 63
Aerial roots of a tropical grape vine, remarkable, 139, *140*
Albizzia Julibrissin, 108; flowers, *109*; fruit, *109*.
Algae, light produced by, 43
Amarcrinum Howardii, 37
Amaryllis, 37, 86; *Belladonna*, 37, 84, var. *blanda*, 84
Amateurs, gardening course for, '21; advanced course, 146; elementary course, 144
Amorphophallus Titanum, importation of bulbs, 2
Annual bequests, 18
Annual reports: of the Director, 1; of the Herbarium, 26; of library and publications, 30
Ant-inhabiting orchids, *97*, 99
Apprenticeships, Garden, 21
Arboretum, 14; comparison of amount of sunshine at Garden and, 15; prickly pear in fruit at, 141, *141*; construction work at, 14; native plants in flower at, May 10, 1933, 91; orchards at, 14; orchids at, 14
Aroids, 7
Attendance for the year 1932, 13
Azalea display, 8

B

Bacteria, light produced by, 43
Banquet, Annual Trustees', 19
Birds as an aid in growing plants, 99
Bromeliads, 7
Bulbophyllum barbigerum, 97, *97*; *Dayanum*, 97, *98*; *Lobbi*, 97, *98*
Bulbous plants for St. Louis. II, 84

C

Cacti: and their culture, 81; growing from seed, 41; in the home, 41, *82*; potting, 82; propagation, 81; rest period, 83; soil, 81; watering, 41, 82, from below, 108, *108*; winter care of, 107
Cactus, 41; "Old Man", 42; prickly pear, 141; Star, 134
Camass, 84
Camassia, 84; *Cusickii*, 85; *esculenta*, 85; *Fraseri*, 85
Canal Zone Tropical Station, 16
Carnations, preservation in sand, *105*, 106
Carrion flowers, *133*, 134, *134*
Cattleya Deckeri, 18
Ceropegia Sandersonii, 96, *96*; *stapeliaeformis*, 96, *96*; *Woodii*, 95, *96*
Ceropegias, 95
Cheiridopsis peculiaris, *42*
Chenopodium ambrosioides, 141
Chestnut grove at Arboretum, 14
Chinese lantern plant, 130
Chlidanthus fragrans, 85
Christmas flower show, 9
Chromophyton Rosanoffii, 43
Chrysanthemum show, *8*, 9; Japanese tea house, a feature of, *9*
Chrysanthemums, preservation in sand, *105*, 106
Cineraria display, 8
Cirrhopetalum Medusae, *95*, 98
Citrus fruits, 7
Coffee and Banana house, 6
Conifers at the Arboretum, 14
Conophyton Luisae, *42*; *Vanrhyndorpense*, *42*
Conservatories, main, 5
Cook, Mr. John W., Mexican sunflowers grown by, 40, *40*

Corpse light, 43
Cosmos preserved in sand, *105*, 106
Crawshay's use of dry sand in preserving orchids, 136
Crindonna memoria Corsii, 37
× *Crinodonna Corsii*, 37, *37*, 39
Crinum Moorei, 37
Crown Imperial, 85
Cycad-Fern house, 6
Cycas Rumphii, 6
Cycnoches Warscewiczii, 18
Cymbidium, 109

D

Daffodils, dried and fresh, *105*
Dahlia show, 9
Davis, Dwight F., orchid collection, 109, *Vanda Sanderiana* from, *15*
Decoration in the home, winter, an old but newly discovered plant for, 129
Degrees awarded to students in Shaw School of Botany in 1932, 22
Dendrobium bigibbum, 144; *Fitzgeraldii*, 142; "Greystone," 143; "Pauline," 142; *Phalaenopsis*, 142, forms of flowers, *143*, var. *Schroederianum*, 115, *115*, 142; *superbiens*, a natural hybrid *(D. Phalaenopsis × D. undulatum)*, 142, *142*, forms of flowers, *143*; *undulatum*, 142
Dendrobium orchid, 109; flowers from seed, 115; the story of, 115
Desert scene, miniature, displayed at the Garden, *81*
Diacrium bicornutum, 98, *99*, showing hollow which ants inhabit, *97*; *bilamellatum*, 99
Director, forty-fourth annual report of the, 1
Display gardens, 9
Dodge, Dr. C. W., activities of, during 1932, 19
Dry sand treatment for preserving flowers, 105; "dry sand treatment" again, 136

E

Echinocereus, 82
Economic garden, 11
Economic house, 6
Entomologist at the Garden, 4
Exhibit illustrating plant responses, special, 75

F

Fellowships in the Shaw School of Botany, 22
Ferns, 6
Fertilizing trees and shrubs, 11; water-lilies, 51
Flora of postage stamps, 122
Floral display house, 7; new exit in, 1
Floral displays, indoor, 8
Florists' spring flower show, 8, 19
Flower sermon, annual, 18
"Flower of the Incas," 40
Flowers, dry sand treatment for preserving, 105, *105*, 136
Foliage plants, display of, 9
Fritillaria Imperialis, 85; *meleagris*, 86
Fruits used in winter decoration, 129, *129*
Fungi; destruction of trees by, 62; light-producing, 44

G

Gaillardias, preservation in sand, 105, *106*
Gardening course for amateurs, 21, advanced course, 146, elementary course, 144
Graduate students in the Shaw School of Botany, 22
Grammatophyllum multiflorum, 109, *110*; *speciosum*, 109
Grape vine, tropical, remarkable aerial roots of a, 139, *140*
Gray Summit Extension, see Arboretum
Greenman, Dr. J. M., activities of, during 1932, 19
Growing succulents from seed in the home, 41
Gurney, James, the late, introduction of water-lilies by, 50

H

Habenaria alata, 18
Helianthus speciosus, 40
Herbarium, report of, for 1932, 26; distribution of specimens, 28; exchanges, 28; field work, 29; mounting and inserting of specimens, 28; new accessions, 26; statistical summary, 29; use of, 29
Hereroa granulata, *42*
Hippeastrum, 86; *Ackermanni*, 87; *aulicum*, 86, 87, var. *glaucophyllum*, 87, var. *platypetalum*, 87; *equestre*, 88, var. *major*, 88; *Johnsonii*, 39; *Reginae*, 39; *rutilum*, 88; *vittatum*, 39, 86
Horticultural Society, 4; dahlia show, 9; display of Mexican sunflowers at flower show, 40, *40*; spring flower show, 9
Howard's, Mr. F., account of Amaryllis hybrid, 38
Hybrid orchids studied by preservation in dry sand, 136
Hymenocallis galvestonensis, 89; *occidentalis*, 88

I

Insect damage: at Tropical Station, 17; to trees, 62
Iris in American Iris Society test garden, 11
Italian garden, 11

J

Jerusalem cherry, 130

K

Killdeer, the, 99; in the Garden, *100*
Knolls, new planting in, 9

L

Labeling of plants, 10, 12
La Garde, Dr. Roland V., activities of, during 1932, 20
Lectures, scientific and popular, by members of staff, during 1932, 24
Library and Publications, report of, for 1932, 30: Garden publications, 32; new accessions, 33; statistical summary, 34; use of, 31
Light, plants that produce, 42
Lily-of-the-palace, 87
Lily, Barbados, 88; Belladonna, 84; fairy, 89; Missouri spider, 88; spider, 89; zephyr, 89
Linnean garden, 10
Linnean house, 7
Lotus, sacred, 49
Luciferase, 45
Luciferin, 45

M

Main garden, 11
Maples, best time for pruning, 61
Marliac, M. Latour, water-lilies introduced by, 50
Medal, Henry Shaw, offered at the National Flower and Garden Show, *1*, 3, 19
Medicinal garden, 11
Medusa's head, *95*, 98
Mesembryanthema, 6, 42
Mexican sunflower, 40, *40*
Missouri primrose, 132, *132*
Möller's "Deutsche Gärtner-Zeitung," burlesque article from, 55; illustrations from, *56*, *57*
Monadelphus illudens, 44
Moss, luminous, 43
Museum and Library building, use of, 3

N

Narcissi, preservation in sand, *105*, 106
Nasturtium, light radiating from, 42
National Flower and Garden Show, 3; Henry Shaw medal offered at, *1*, 3, 19
Native plants in flower at the Missouri Botanical Garden Arboretum, Gray Summit, Mo., May 10, 1933, 91
New or noteworthy plants for St.

Louis. I, 37; II, 40; III, 83; IV, 108; V, 120
Nightshade family, fruits of, used in winter decoration, 130
Nursery at the Arboretum, 15
North America, vegetation-pictures from, 55, *56*, *57*
Nymphaea "August Koch," 53; *Burttii*, 50; *caerulea*, 49; *Daubeniana*, 53; *devoniensis*, 50; *kewensis*, kept dormant in sand for four years, *49*, after being kept in the propagating tank for three weeks, *49*; *Lotus*, 49; "Panama Pacific," 53; "Mrs. G. H. Pring," 50; "St. Louis," 11; *Stuhlmannii*, 50; *tetragona*, 49; "Mrs. Woodrow Wilson" *gigantea*, 53

O

Odontoglossum crispum, 137; *luteopurpureum*, 137; *Powellii*, 18; *Wilckeanum*, 137
Odontoglossum hybrids, preserving, in dry sand, 136
Oenothera biennis, 133; *fruticosa*, 133; *linearis*, 133; *missouriensis*, 132, *132*; *rosea*, 132; *speciosa*, 132, *132*
Opuntia Opuntia, 141; *Rafinesquii*, 141, *141*; *vulgaris*, 141
Orchid: bearded, 97; bearded lip, 97; cow-horn, 99; nodding, 98; swinging lip, 97
Orchid show, 8
Orchids: at the Arboretum, 15; at the Tropical Station, 17; bouquet presented to the Queen of the Veiled Prophet by the Garden in 1932, *14*; collecting, in Panama, 17; from seed, used in V. P. Queen's bouquet, 115; hybrids, 136, 142, in the Garden collection, 7, curious, 96; preservation in sand, *105*, 106, 136; story of the Dendrobium, 115
Outdoor planting, 9

P

Palm house, 5
Palms at the Garden, 5; at the Tropical Station, 18
Pancratium, 89; *canariense*, 89; *illyricum*, 89; *maritimum*, 89; *Sickenbergeri*, 89; *zeylanicum*, 89
Pandanus Sanderae, 139, *139*; root cap of, 139, *140*
Plant responses, special exhibit illustrating, 75
Plants for St. Louis: bulbous, II, 84; native, in flower at the Missouri Botanical Garden Arboretum, May 10, 1933, 91; new or noteworthy, I, 37; II, 40; III, 83; IV, 108; V, 120
Plants that produce light, 42
Pleurothallis villosa, 98
Poinsettias, 9
Postage stamps, the flora of, 122
Preserving flowers, dry sand treatment for, 105, *105*; "dry sand treatment" again, 136
Prickly pear in fruit, 141, *141*
Primroses, some interesting, 132; evening, 133; Missouri, 132, *132*; white evening, 132, *132*
Propagating and Growing Houses, 7
Pruning: best time for, 61; definition of term, 61; experiments with silver maples, 64
Pterocarya fraxinifolia, 121; *Rehderiana* Schneider, 120, branch of, showing mature seed, *120*, growing in the Missouri Botanical Garden, *121*, showing typical bark fissures and numerous suckers from the surface roots, *121*; *stenoptera*, 121
Published articles of staff and students during 1932, 23

Q

Quamash, 84

R

Ragionieri's account of new Amaryllis hybrid, 37

Renanthera coccinea, 18
Research and instruction, 19
Reynolds, Dr. E. S., activities of, during 1932, 20
Rhododendron dell, 15
"Rhubarb House" at the World's Fair, 56, *57*
Rimaria Heathii, *42*
Roots, 139; remarkable aerial, of a tropical grape, 139, *140*
Rose garden, 10

S

St. Elmo's fire, 43
St. Louis: German article burlesquing, and World's Fair, 55, *56*, *57*; bulbous plants for, II, 84; new or noteworthy plants for, I, 37; II, 40; III, 83; IV, 108; V, 120
St. Louis Horticultural Society: dahlia show, 9; Mexican sunflower at flower show, 40, *40*; spring flower show, 9, 19
Sand, dry, treatment for preserving flowers, 105, *105*; "Sand, dry, treatment" again, 136
Schistostega osmundacea, 43
Schomburgkia tibicinis, *97*, 99, *99*; pseudobulbs, showing opening for ants, *97*
School of Occupational Therapy, gardening course given to, 21
Shaw, Henry, commemoration of 43rd anniversary of death, 4
Shaw medal, *1*, 3, 19
Shaw School of Botany, graduates and fellows in, 22
Shellac as a pruning dressing, 72
Shrubs: fertilizing, 11; pruning, 12; spraying, 12; planting, 12
Silk tree, 108
Society of American Florists and Ornamental Horticulturists, entertained at Garden, 75
Solanum aculeatissimum, 129, *129*; *Balbisii*, 129; *ciliatum*, 129
Spring Flower Show, 8
Stapelia gigantea, *133*, 136; *hirsuta*, 135, *135*; *variegata*, *134*, 135, *135*
Stapelias, 134, *134*, *135*; culture, 135; description, 134; thriving among limestone, *134*; types of flowers, *133*
Star flower, spring, 89
Statistical information for December, 1932, 36; January, 1933, 47; February, 59; March, 79; April, 94; May, 103; June-August, 111; September, 126; October, 138; November, 149
Stilt plant, 139, *139*; root cap of, *139*, 140
Succulent House, 6
Succulents, 6, *41*, *42*; growing from seed in the home, 41; seedlings of, *41*; watering, 41
Sundrops, common, 133; narrow-leaved, 133
Sunflower, showy Mexican, 40, *40*
Sunshine, comparison of, at the Arboretum and Garden, 15

T

Temperature for growing cacti, 107
Titanopsis calcarea, *41*; *Schwantesi*, *41*
Tithonia speciosa, 40, *40*; *tagetiflora*, 40
Tree: cross-section of, showing nearly circular growth, *61*; longitudinal section, showing extent of decay, *61*; treated cuts of a, *62*, untreated cuts, *63*
Trees, 11; at the Arboretum, 14; fertilization of, 11; planting, 12; pruning, 12, best time for, 61; spraying, 12
Triteleia uniflora, 89
Tropical Station, 16; insect pests at, 17; orchids at, 17
Tumboa Bainesii, 124

U

Ulrich, Mr. A. G., descriptions by, of bulbous plants, 84

V

Vanda Sanderiana from the Dwight F. Davis orchid collection, *15*
"Vegetation pictures from North America," 55, *56*, *57*
Veiled Prophet Queen's bouquet, *14*; first orchids from seed used in, 115

W

Walnut caterpillar, 121
Walnut trees, growth of, 11
Watering cacti from below, 41, 108, *108*
Water-lilies, 11, 49; breeding, 50; discovery of yellow, 50; fertilizing, 51; growing, 50; hardy varieties, 51, 54; preservation in sand, *105*, 106; propagation, 52, from seeds, 52, leaf, 53, tuber, 53; tropical varieties, 49, 51, 54
Water-lily pools, 11
Welwitschia mirabilis, 124
When is the best time to prune a tree?, 61
Wilson, Gurney, note by, concerning dry sand treatment of preserving flowers, 136
Wing-nut, 120, *120*, *121*
Winter care of cacti, 107; temperature, 107; watering, 108, *108*
Winter courses in gardening for amateurs, 144
Winter decoration in the home, an old but newly discovered plant for, 129
Woodson, Dr. Robert E., activities of, during 1932, 20

X

Xanthoceras sorbifolia, 83; new shoots of, four weeks after cuttings were made, *83*; potting, *84*; propagation of, 83; rooted cutting of, eight weeks old, *84*; terminal racemes of white flowers of, *83*

Y

Yellow horn, 83

Z

Zephyranthes, 89; *Atamasco*, 90; *candida*, 90; *carinata*, 90; *citrina*, 90; *erubescens*, 90; *Lindleyana*, 90; *longifolia*, 90; *rosea*, 90; *texana*, 90; *Treatiae*, 90; *verecunda*, 90

SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date to the death of Mr. Shaw, in 1889, the Garden was maintained under the personal direction of its founder, and, while virtually a private garden, it was, except at certain stated times, always open to the public. Although popularly known as "Shaw's Garden" the name Missouri Botanical Garden was designated by Mr. Shaw as its official title and in his will or in any of his writings he specifically referred to it as the "Missouri Botanical Garden." By a provision of Mr. Shaw's will the Garden passed at his death into the hands of a Board of Trustees. The original members of the Board were designated in the will, and the Board so constituted, exclusive of certain ex-officio members, is self-perpetuating. By a further provision of the will, the immediate direction of the Garden is vested in a Director, appointed by the Board of Trustees. The Garden receives no income from city or state, but is supported entirely from funds left by the founder.

The city Garden comprises 75 acres, where about 12,000 species of plants are growing. There is now in process of development a tract of land of over 1,500 acres outside the city limits which is to be devoted to (1) the propagation and growing of plants, trees, and shrubs, designed for showing either indoors or outside, at the city Garden, thus avoiding the existing difficulties of growing plants in the city atmosphere; (2) gradually establishing an arboretum as well as holding a certain area as a forest reservation, with the idea that possibly at some future time this may become the new botanical garden.

The Garden is open to the public every day in the year, except New Year's Day and Christmas—week days from 8:00 a. m. until one-half hour after sunset; Sundays from 10 a. m. until sunset.

The main entrance to the Garden is located at Tower Grove Avenue and Flora Place, on the Sarah car line (No. 42). Transfer south from all intersecting lines. The Garden may also be reached by Bus Route No. 12, to which all other motor-bus lines transfer.

STAFF
OF THE MISSOURI BOTANICAL GARDEN

THE GARDEN, 2315 TOWER GROVE AVENUE, ST. LOUIS, MISSOURI

GEORGE T. MOORE,
Director

KATHERINE H. LEIGH,
Assistant to the Director

HERMANN VON SCHRENK,
Pathologist

JESSE M. GREENMAN,
Curator of Herbarium

ERNEST S. REYNOLDS,
Physiologist

CARROLL W. DODGE,
Mycologist

ROBERT E. WOODSON, JR.,
Research Assistant

NELL C. HORNER,
Librarian and Editor of Publications

GEORGE H. PRING,
Superintendent

JOHN NOYES,
Consulting Landscape Architect

WILLIAM F. LANGAN,
Chief Engineer

JOSEPH LANGEN,
Assistant Engineer

ARTHUR D. FORRESTER,
Plant Recorder

ALBERT PEARSON,
Painter

PAUL A. KOHL,
Floriculturist

JOHN H. KELLOGG,
Plant Collector

AUGUST P. BEILMANN,
Arboriculturist

JOSEPH CUTAK,
In charge of Exotics

LADISLAUS CUTAK,
In charge of Succulents

THE ARBORETUM, GRAY SUMMIT, MISSOURI

LARS P. JENSEN,
Manager

GUSTAVE GOEDEKE,
Foreman

DAVID MILLER,
Orchid Grower

ROY E. KISSECK,
Engineer

TROPICAL STATION, BALBOA, CANAL ZONE

A. A. HUNTER,
Manager

REPRESENTATIVE IN EUROPE

GURNEY WILSON, F. L. S.
Hove, Sussex, England